BUILD WITH CALADOBE FOR ENDURING BEAUTY

Foster and Kleiser
COMPANY

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PRICE FIFTY CENTS

I AM THE BUILDER . . .

I am the builder,
Architect of the dreams of man.

I fashion from the rich store of Earth
That hallowed place called home,
The church, the school, the pulsing factory,
A thousand things that mirror man's endeavor.

I build, that man may live in peace
To mold the myriad products of his mind;
I build that children wheresoe'er shall know
The warmth and beauty in the heart of man.

I build for young and old, for rich and poor,
For bright todays and brighter morrows.
I build that men may all be builders:
Masons in more than stone, molders of men.

What man can rightly think, that he can do.
This is my creed.

I am the builder.

. . . Cyril Wright

A GLIMPSE INTO HISTORY

Probably the oldest building material on earth is the earth itself, the soil on which we walk. Natural earth brick, that is—unburned brick, was the building material of ancient Mesopotamia, the "Ur of the Chaldees" from which Abraham came. What is thought by archaeologists to be the biblical "Tower of Babel" is of soil brick. The foundation courses of the Pyramids also are said to be of this same sun-dried brick.

Succeeding civilizations in China, India, Mongolia, Morocco, Italy, Spain, France, Germany, Russia, Scandinavia and England have made wide use of this material. The still visible record they have left behind them is a fascinating page in the story of man.

In the Americas, earth construction dates back also to antiquity. Still to be seen at "Chan-Chan," Peru, and at Casa Grande, Arizona are ancient and elaborate structures of earth that were incredibly old long before the white man came.

The first building erected by the white settlers in what is now the United States is said to be the "Palace of the Governors" in Santa Fe, New Mexico, built of sun-dried, or "adobe" brick in 1609. Originally the seat of the territorial government, it is now a state museum.

Earth-wall and sun-dried brick houses were erected by early settlers on the Atlantic seaboard. Examples are still to be found from the New England states to South Carolina.

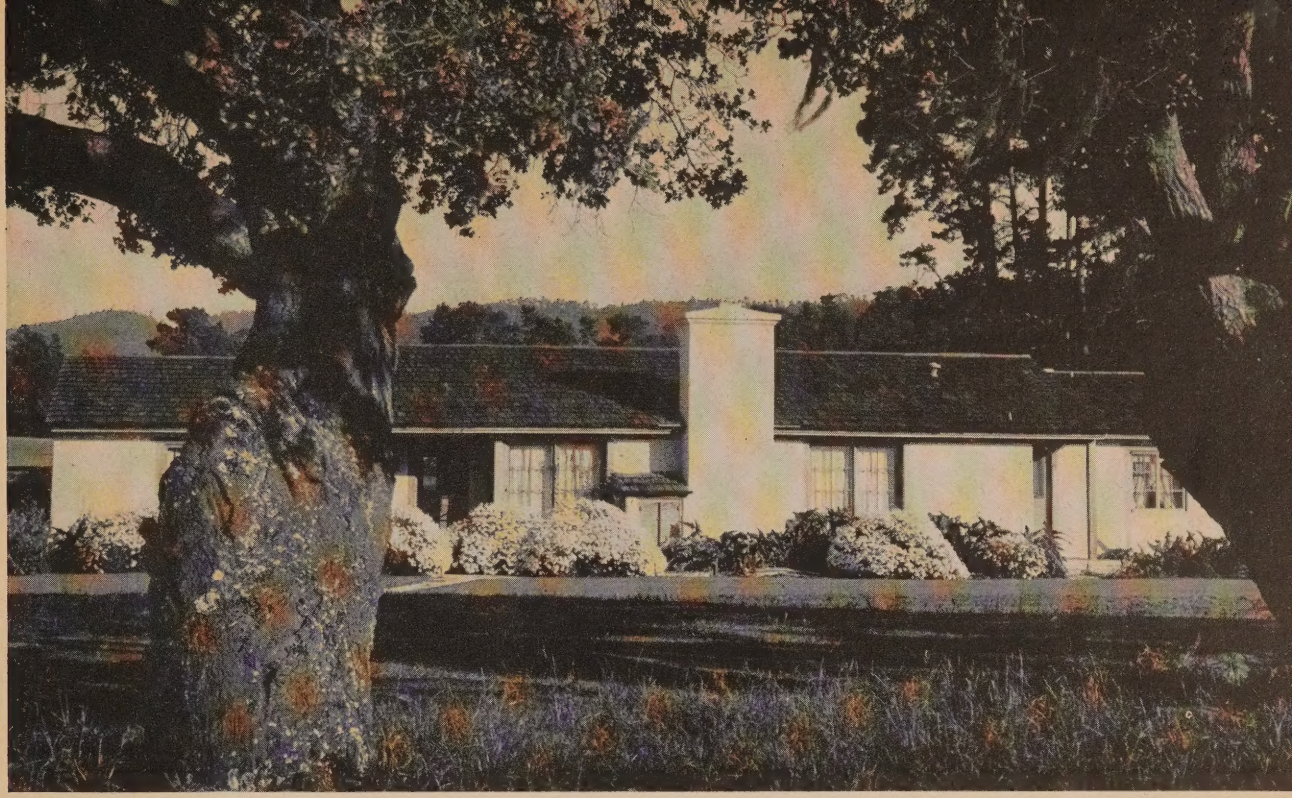
But, it was in the Southwest and particularly in California that this type of construction was most used in pioneer days. Here, many types of buildings were of this material—the Spanish missions, the haciendas of the great landed families, fortifications, miners' cabins and public buildings.

The romantic charm of these adobe buildings of the Southwest came not alone from the story-book activities in them and about them, but from their remarkably harmonious blending with their surroundings and from their "livability." There is about this adobe, or earth construction, a "fitness" which gives it an unequalled partnership with its surrounding countryside and with gracious living.

However, adobe or sun-dried brick as used particularly in the Southwest had two important disadvantages. One of these was its solubility. Unless constantly re-finished or protected in some manner from the rains or other water action, it disintegrated rapidly. Thus, its use was confined chiefly to areas with limited rainfall. The other weakness, stemming chiefly from the manner in which it was used, was its lack of adequate resistance to earthquake forces.

These disadvantages combined to retard greatly the utilization of adobe or sun-dried brick in more recent construction.

It is these disadvantages that Caladobe, the outstanding building material presented in this book, has overcome. Caladobe thus provides a building material that combines the very real advantages of the age-old "soil brick" with durability, resistance to water that is far greater than that of concrete, and other qualities that meet the most rigid F.H.A. or Building Code requirements.



Stabilized soil (adobe) brick home of Mr. and Mrs. Walter F. H. Schultz, Del Monte, California. Hugh W. Comstock and John H. Neikirk, Builders.

WHAT IS CALADOBE?

Caladobe is a soil brick made with scientifically selected soils, combined with fiber, water and the exact proportion of "Bitudobe" Emulsified Asphalt Stabilizer required to impart maximum moisture resistance. These are mixed, under positive control, until the adhesive colloidal clay particles are covered with a microscopically thin film of asphalt Stabilizer. This coating "water-proofs" the colloidal clay so thoroughly that a Caladobe brick will absorb only 1% to 2% of moisture. By comparison, untreated soil brick will absorb from 25% to 30% of moisture; average good concrete, 8%; and timber, as much as 15%. This process of "stabilizing" soil brick, pioneered and developed by the American Bitumuls Company, has been thoroughly checked and affirmed by many investigators, including the laboratories of Building Code officials, State Agricultural Colleges, U. S. Departments of Interior and Agriculture, and U. S. Bureau of Standards. The conformity of the finished product, Caladobe, with the requirements of the most rigid building standards is shown by the table below.

	Foster and Kleiser CALADOBE	Requirements of No. Calif. Dist. F.H.A.	Requirements of *Uniform Bldg. Code 1943 Edition
Compression	375-400 psi	350 psi	300 psi
Modulus of Rupture	60 psi	40 psi	50 psi
Tension	40 psi	—	—
Absorption (under laboratory test)	2%	—	2½%
Erosion (under pressure in laboratory test)	1/16"	—	1/16"

*Uniform Building Code of the Pacific Coast Building Officials Conference.

Franklin and Kump were the architects of this delightful stabilized adobe home in the Fig Garden District of Fresno, California.

WHAT ARE SOME OF THE ADVANTAGES OF CALADOBE?

EFFECTIVE ARCHITECTURAL DESIGN • Caladobe bricks lend themselves to effective design in a wide range of architectural styles. Not only in the Mission and Spanish types to which they are eminently suited, but in the Modern, Norman, English, Cape Cod and many others, they impart to homes and other buildings a distinctive and enduring charm.

Buildings of Caladobe have massiveness and solidity, and a close sympathy with their environment which is difficult to achieve with materials which are farther removed from their natural state. The photographs and architectural drawings presented in this brochure are evidence of these attractive design possibilities of Caladobe brick buildings.

PERMANENCE • Caladobe brick buildings are exceptionally durable, if constructed in conformity with sound engineering practice. Dry soil is as changeless as any material with which engineers deal. In Caladobe bricks the soil remains dry, being practically 100% resistant to moisture. By keying the bricks in walls, using water-resistant cement mortar, employing steel reinforcement at critical points and horizontal trussing of roofs, adequate resistance even to earthquake forces is provided in Caladobe construction.

The home of Mr. Tom Milam, Palo Alto, California, the first of several stabilized adobe homes designed and built by Mr. and Mrs. F. C. Price, Jr.

EARTHQUAKE RESISTANCE • The belief that earthquakes are an inescapable menace to masonry type buildings is known to be erroneous by most structural engineers. Mr. Hal Colling, Secretary of the Pacific Coast Conference of Building Officials, the largest organized body of building code officials in the United States, issued the following statement after investigation of the damage to buildings in Imperial Valley, California, as a result of the earthquake of May 14, 1940. (Building Standards Monthly, June, 1940.)

"As in practically every other earthquake of which an analysis has been made, the fact has again been emphasized that adequate design will prevent earthquake damage to buildings and that any standard material may be used safely if construction methods are sound."

The engineering data for Caladobe construction, presented on subsequent pages of this book, will provide for this "adequate design" for earthquake resistance. (Particularly Data Sheet No. 110, Page 36.)

MOISTURE RESISTANCE • There are two ways in which moisture is a menace to building materials and to buildings—direct contact of water, and moist air. Absorption of moisture by the material itself from either of these sources destroys paint coatings and induces deterioration and decay. In lumber, moisture creates an environment favorable for destructive insects. Caladobe bricks are highly resistant to pene-

Charming loggia of the modern stabilized adobe home of Mr. and Mrs. Earl Houghton near Lindsay, California. Designed by Clarence Cullimore, A.I.A.

tration of moisture, both from direct contact with water or from vapor. Not even beating rains can penetrate Caladobe. No soil material is used by Foster and Kleiser Company in making Caladobe bricks unless the "Bitudobe" asphaltic treatment reduces its absorption to below 2% upon exposure to free water for seven days. Moisture absorption is often found by this test to be less than 1%. This advantage of Caladobe is underscored when comparison is made with the 8% absorption of average good concrete and the absorption up to 15% for timber.

FIRE RESISTANCE • Caladobe bricks will not support combustion. The only possibility of fire in Caladobe buildings is in those minor portions of the building which may be constructed of inflammable materials, and in interior fittings and decorations. Since the Caladobe walls cannot burn, Caladobe construction keeps fire hazard at a minimum.

INSECT PROOF • Caladobe bricks are inherently free from attack by termites or other destructive insects. Insects which normally live in damp earth are repelled by the lack of moisture and by the inhibiting ingredients of "Bitudobe" Stabilizer.

SOUND DEADENING • Caladobe walls are virtually soundproof without further use of artificial sound-deadeners. Traffic noises do not intrude. With interior partitions of Caladobe brick, radio programs or loud conversations are practically inaudible to occupants of adjacent rooms.

Living room corner in home of Mr. and Mrs. F. C. Price, Jr., Los Robles Road, Palo Alto, California. The natural adobe wall texture has been preserved by using a simple wash applied directly to the brick.

EXCELLENT NATURAL INSULATING PROPERTIES • Official tests of the thermo-conductivity of Caladobe brick walls have established an unusually favorable heat transmission factor. Not only is soil itself a good insulator, but the wall sections are built to greater thickness than is customary with other building materials. Thus, Caladobe buildings maintain a uniform interior temperature.

COOL IN SUMMER — Caladobe buildings are cool in hot weather. When outside temperature is 100° F. or more, inside temperature can be maintained from 20° to 30° lower by keeping the doors and windows closed during the heat of the day. Artificial cooling devices are not needed in Caladobe buildings.

WARM IN WINTER — The interiors of Caladobe buildings retain warmth to a degree unsurpassed by any other type of construction commonly employed for dwelling use. Fuel for winter heating of Caladobe buildings therefore becomes a small item in the family budget.

NO INTERIOR SWEATING • Because of its excellent insulating properties, Caladobe walls are free of the annoyance of condensation or sweating commonly found in other masonry construction. The inside surfaces of the thick Caladobe walls remain approximately at room temperatures regardless of outside temperatures, thus preventing this unpleasant condensation on interior walls.

Child's bedroom in Santa Barbara home designed and built by William Scott. Note that stabilized adobe walls have been plastered and tinted.

EASY TO DECORATE • If one does not prefer the warm natural earth tones of the material itself, Caladobe brick walls may be painted and tinted to any shade. Lengthy trials have established the durability of methods of painting using an inexpensive prime coat as the base. (See Specifications, Pages 42-46.) Results at least equal to paint coats on any other material can be achieved on both exterior and interior wall surfaces by following our recommendations, and at much lower cost than for painting other types of surface, because of less expensive materials and application methods.

Should plastering be desired to conceal the irregularities of the brick units, this can be done readily as Caladobe brick provides excellent mechanical bond. Plastered walls may be tinted, painted, papered or canvassed, to meet the preference of the owner, without fear that capillary moisture will later mar the finish. No other masonry units offer such opportunity for economical wall finish.

LOW MAINTENANCE COST • The inherent durability of soil fully protected by "Bitudobe" asphalt treatment against moisture provides exceptionally low maintenance cost for properly constructed Caladobe buildings.

OUTSTANDING FOR UTILITY BUILDINGS • The illustrations herein show mainly the attractive architectural effects which are possible in Caladobe residen-

Redwood and stabilized soil brick textures are combined to create interest in the living room of this Del Monte home.

tial buildings. However, Caladobe buildings measure up also to the requirements of the hardest usage, and have the ruggedness that is necessary for farm buildings, such as workmen's barracks, storage sheds, horse barns, sulphuring sheds, dried fruit storage, winery buildings, etc., where utility is more important than appearance. The fact that Caladobe bricks are used by U. S. military authorities for protection works, and withstand bomb shocks and machine-gun fire to the satisfaction of military engineers, indicates their ability to take punishment.

SUMMARY OF ADVANTAGES • The illustrations in this book graphically portray the architectural charm of buildings of stabilized soil brick. Where ruggedness rather than beauty is desired, as in industrial buildings, ranch worksheds, etc., Caladobe also more than meets the most severe specifications.

The moisture resistance of Caladobe, together with its fireproof and insect-proof qualities, combine to provide extraordinary durability, unmatched by any other building material. Its adaptability to a wide variety of decorative finishes contributes to its gracious "livability," as does its sound proofing and unusual insulating properties. The economy in heating and cooling expense it provides, plus its minimum maintenance cost make Caladobe construction a friend of every budget. Caladobe insures not only enduring construction but lasting satisfaction.

COST OF CALADOBE CONSTRUCTION

Editorial from California Homes, March, 1937. (Used for peacetime comparison.)

"Sound adobe construction, while not expensive, is not cheap in comparison to other types of buildings. True, it is possible to build a cheap mud house, just as it is possible to build a cheap box house from rough one-by-twelves and battens. But neither can be classed as anything better than the most primitive sort of shelter, with all of the advantages, if any, on the side of the cheaply constructed frame house.

"A careful comparative cost analysis recently compiled in the San Francisco Bay area shows that the difference in cost of a five-room dwelling built of stabilized adobe, as compared to a similar dwelling of standard wood frame construction is almost negligible. The estimates showed that an adobe house, with wood floors, and no ceiling insulation, could be built at a cost of $3.56 per square foot of gross area, while a similar uninsulated house in frame construction would cost $3.58 per square foot.

"Adobe builders, however, feel that the only fair comparison is that of adobe as against frame construction fully insulated. In a comparison of this kind, adobe shows up to advantage, since it requires no insulating excepting at the floors and ceilings. Thus, a fully insulated frame house shows on the estimate at $3.84 per square foot of gross area, while its counterpart in adobe could be built for $3.66. The minimum requirements of the FHA were followed in each instance."

★ ★ ★

It will be noted that the comparisons above, which favor stabilized adobe construction, are on the basis of "gross area." A Caladobe home or other building, having the same gross area as a frame building, will have a smaller inside area by virtue of the thickness of its walls. Thus, a comparison on the basis of inside or "net living area" *may* favor slightly the frame construction (IF postwar lumber prices drop back to prewar levels).

In order to be completely fair in our statement of comparative costs, we prefer to lean even more to the conservative side and to assume that sound adobe construction will cost approximately 10% more than frame construction, based on comparable "net living area." This assumed 10% additional, however, is more than compensated for in the added durability of Caladobe construction, the insulating values, sound-proofing, insect-proofing, fire resistance, lower maintenance cost and other advantages.

Patio of the Samuel Hopkins Carmel residence.

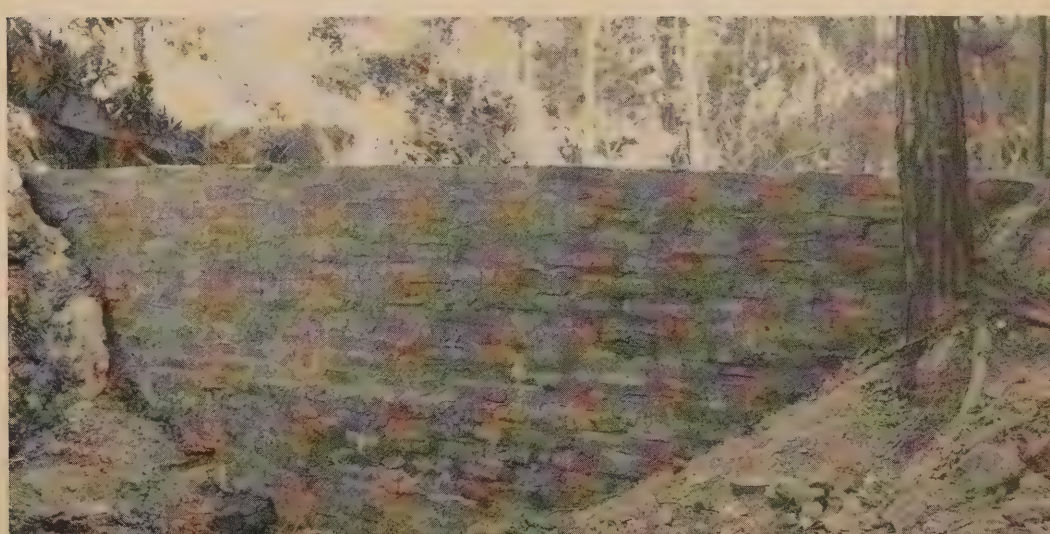
SOME OF THE USES OF CALADOBE

Caladobe bricks lend themselves to a wide variety of building uses, many of which have been pictured in the photographs and drawings in this book. Here are some of them:

AUTO COURTS AND HOTELS
BLAST WALLS
BARBECUE PITS
CHURCHES
SMALL DAMS
(FOR SOIL CONSERVATION)
DRIVEWAYS
FARM BUILDINGS
HOMES
BUNKHOUSES
CHICKEN HOUSES
STORAGE BUILDINGS
FIREPLACES
FIRE WALLS
FLOORS
FOUNTAINS
GARAGES
GARDEN POOLS
GARDEN WALLS
GAS STATIONS
GATE POSTS
HOMES
INDUSTRIAL BUILDINGS
IRRIGATION DITCH LINING
PATIOS
PUBLIC BUILDINGS
REFRIGERATION BUILDINGS
RETAINING WALLS
SCHOOLS
SHELTERS
(AIR RAID, ETC.)
STEPPING STONES
STEPS
STORES
TERRACES
VENEERS
WALKS

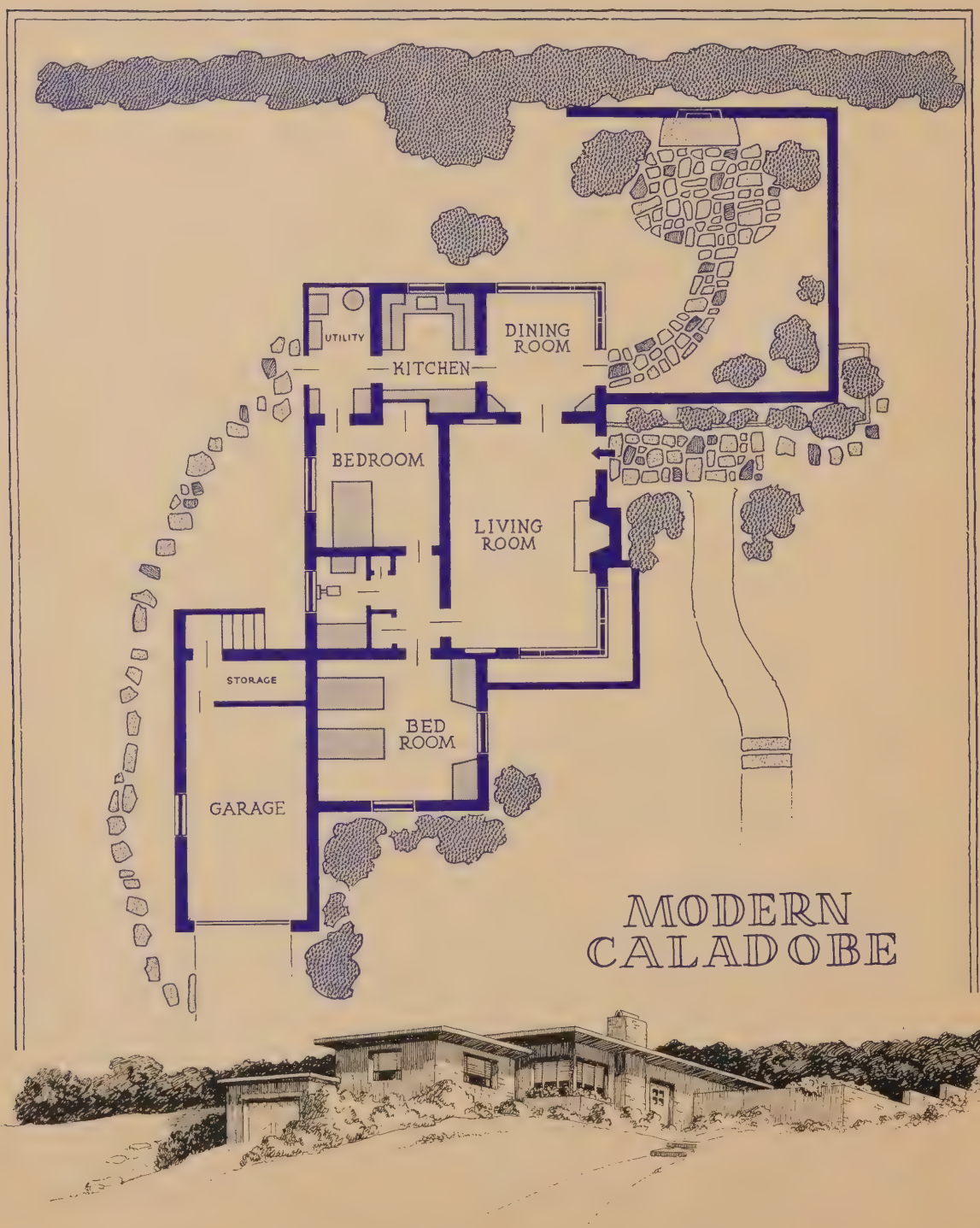
An unusual use of stabilized adobe — A Carmel garden dipping pond.

Stabilized adobe dam in a canyon garden. Built as part of a modest soil conservation program.

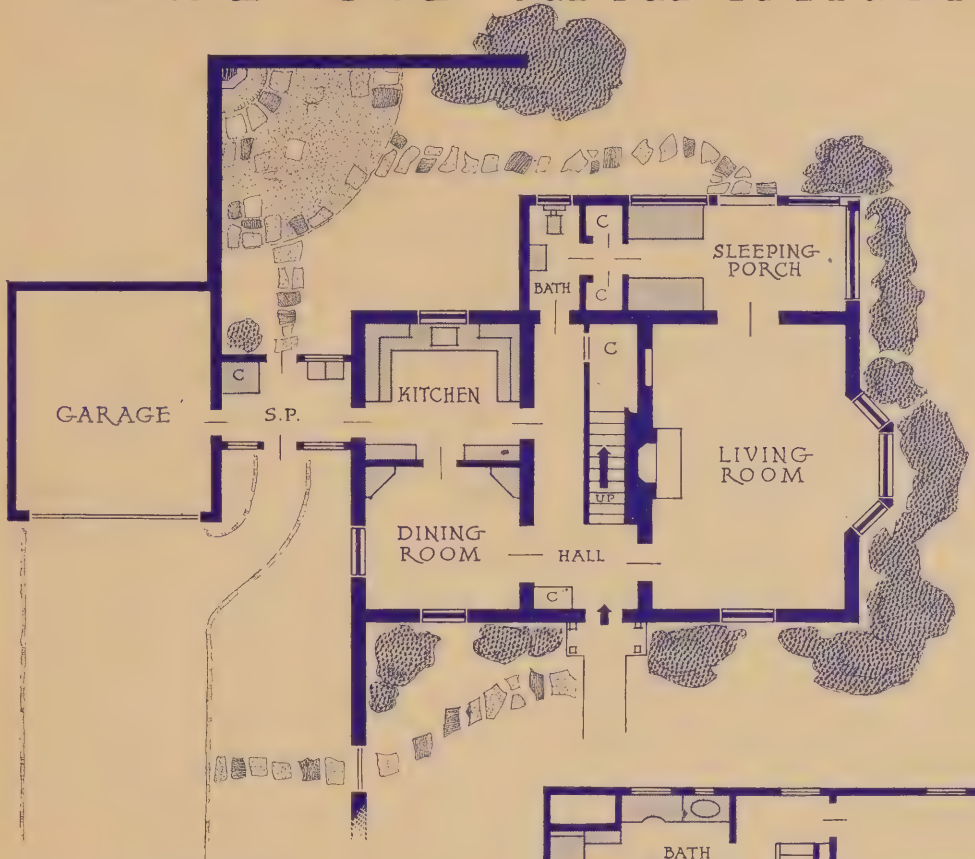


SOME HOME PLANNING IDEAS

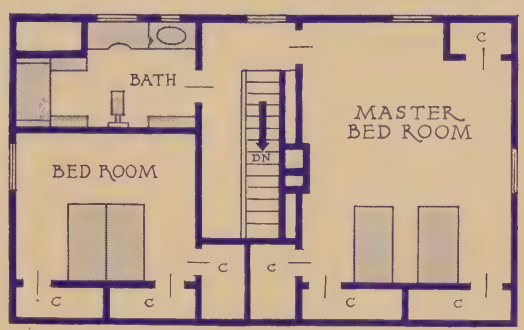
Six different floor plans and elevations of Caladobe homes, created by Hugh W. Comstock, in six different architectural styles, are shown here. These suggest some original possibilities for variety and individuality to be found in Caladobe construction.



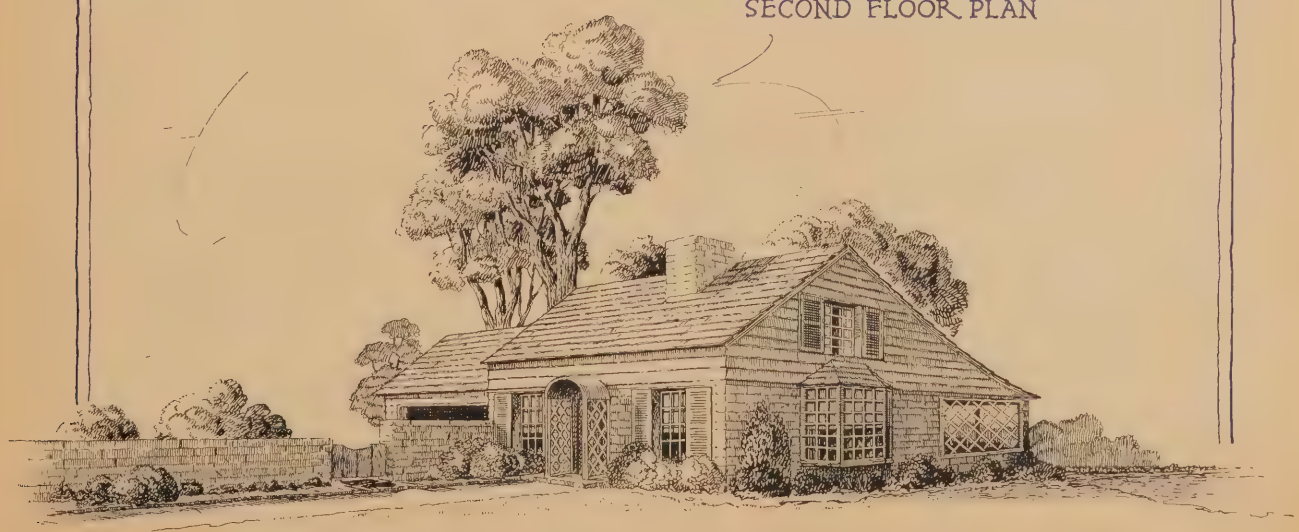
CAPE COD ADAPTATION



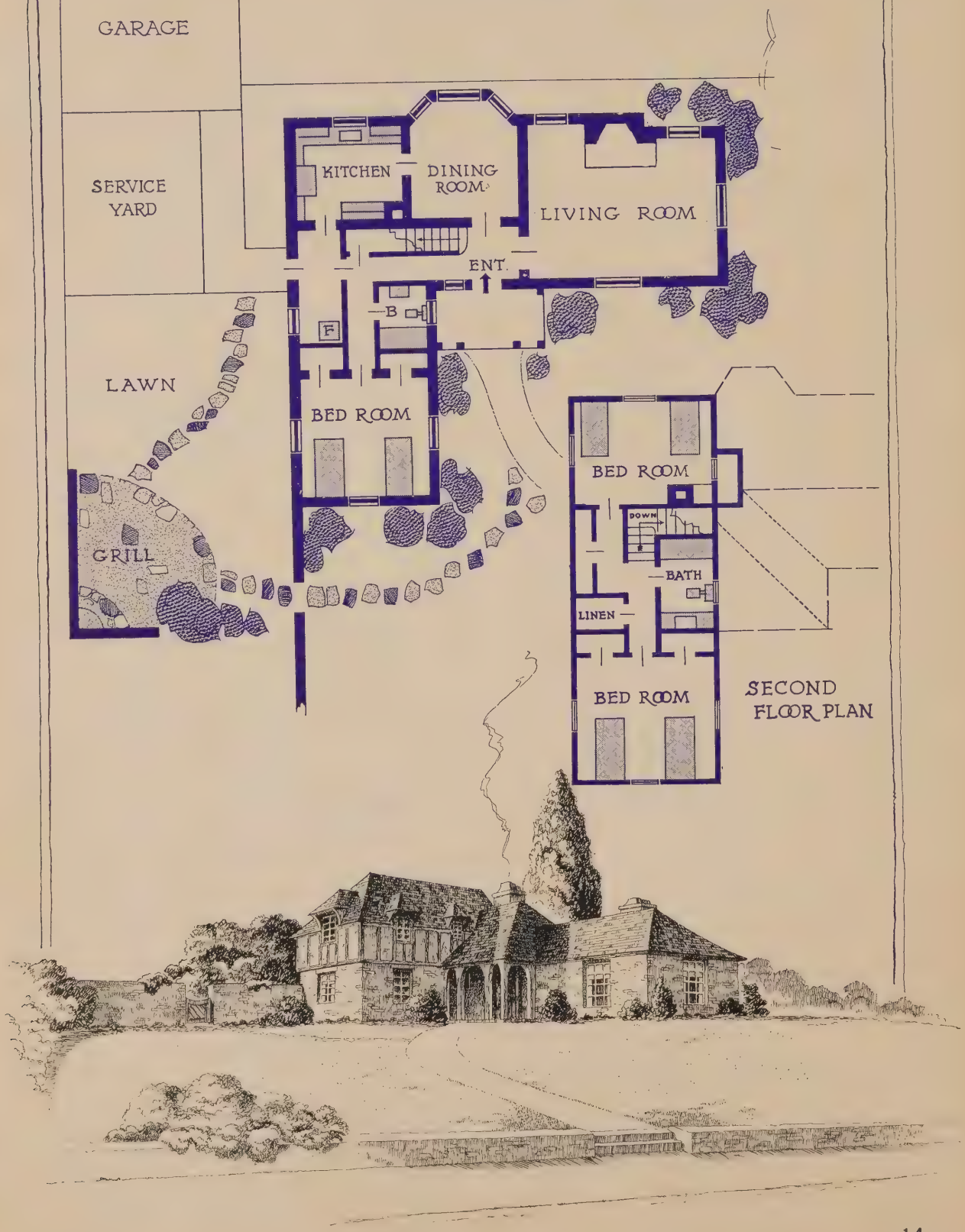
FIRST FLOOR PLAN



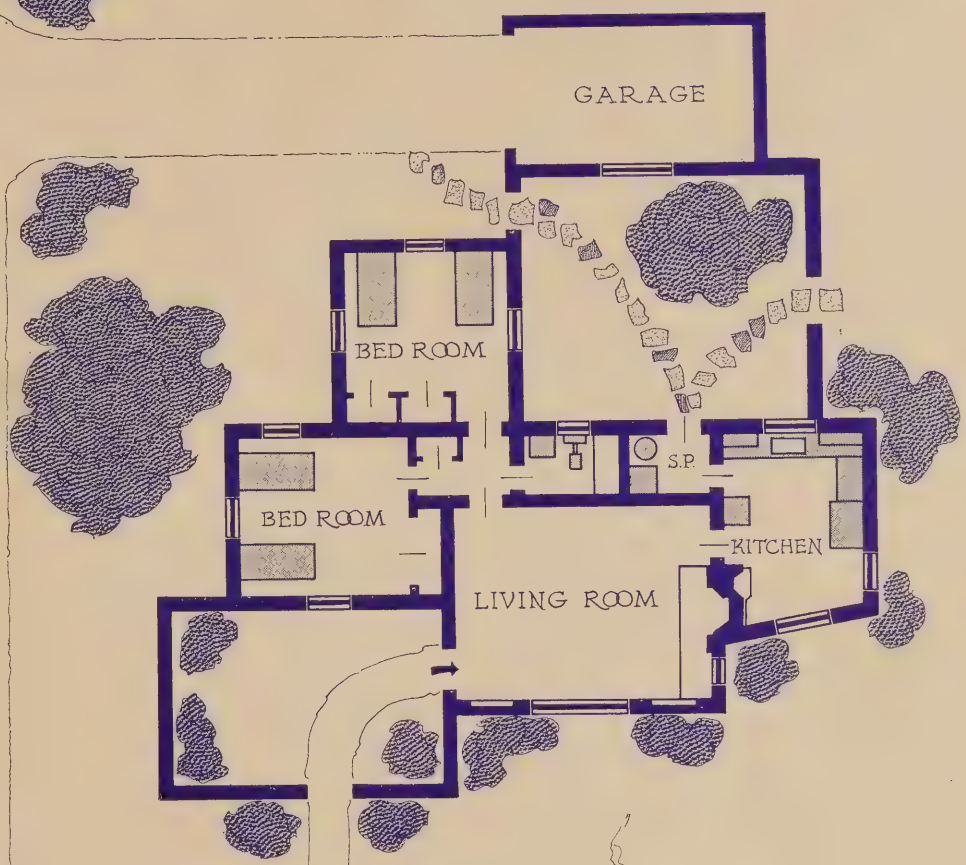
SECOND FLOOR PLAN



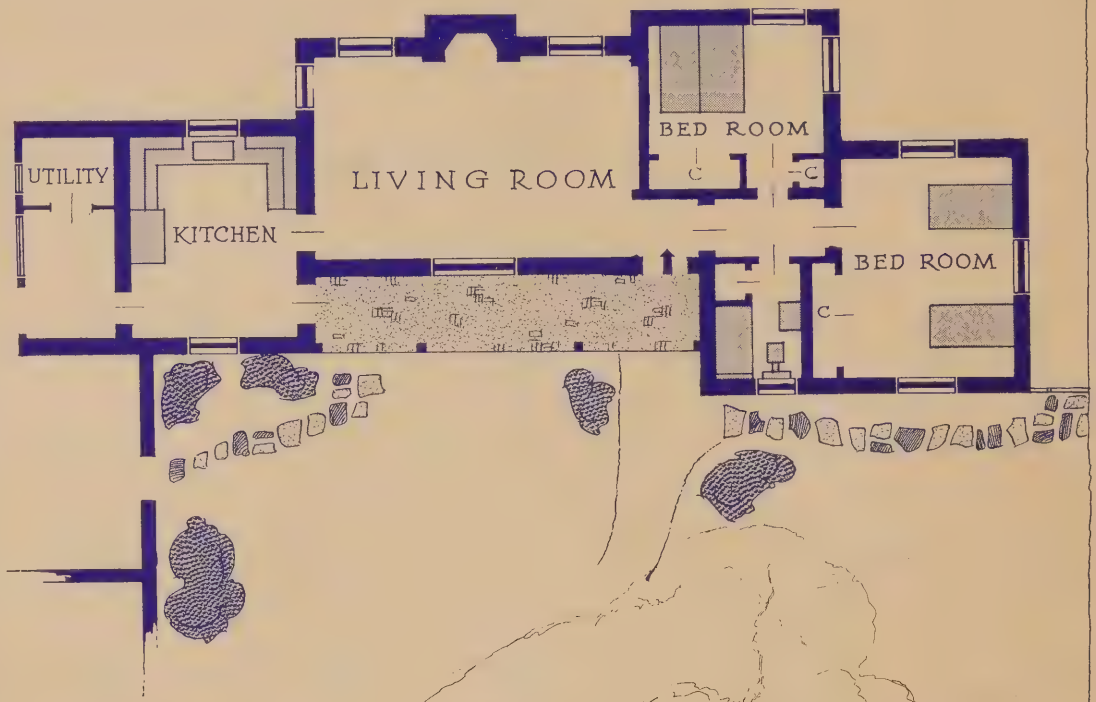
ELIZABETHAN HALF TIMBERED COUNTRY HOME

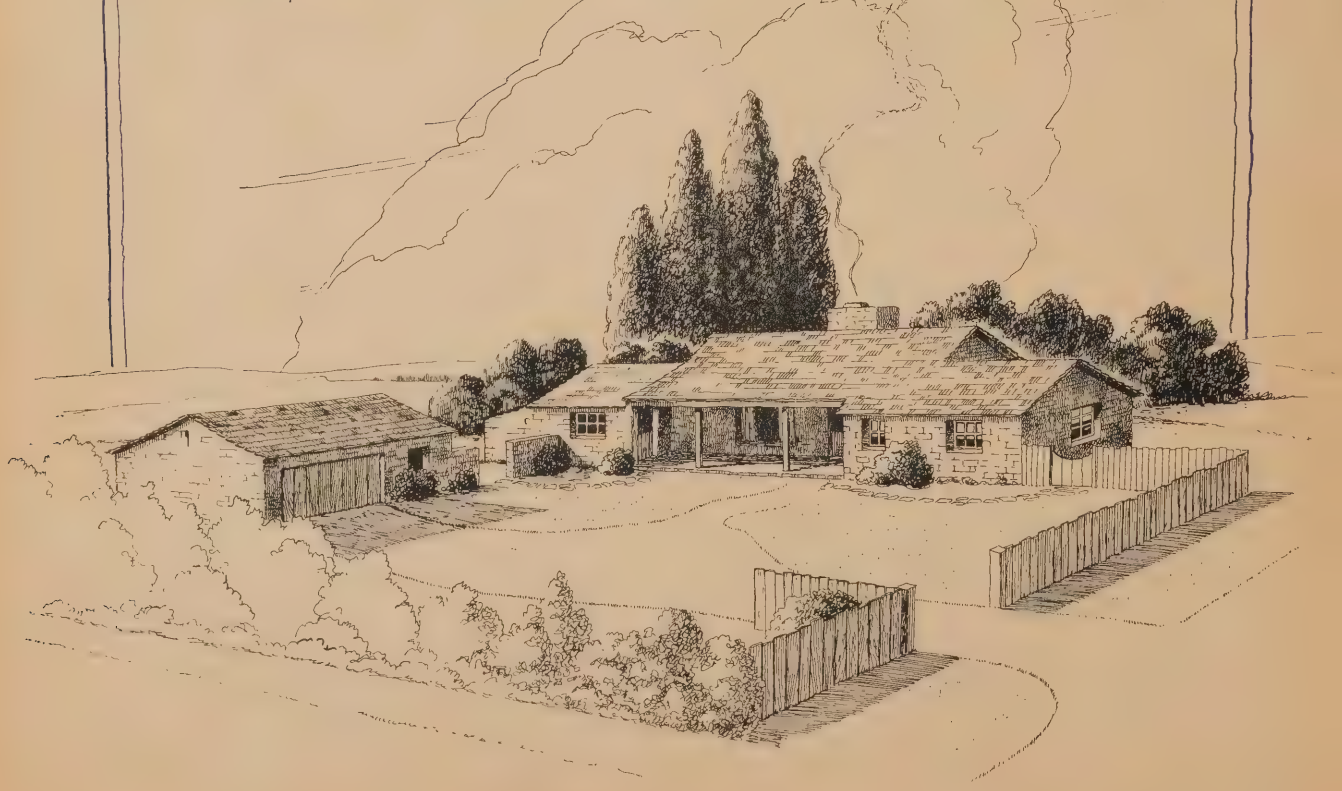


NORMAN PEASANT
CALADOBE

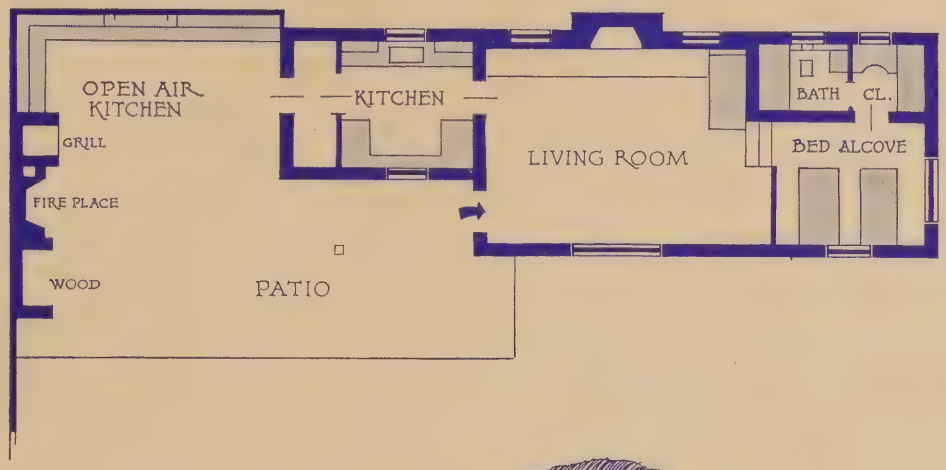


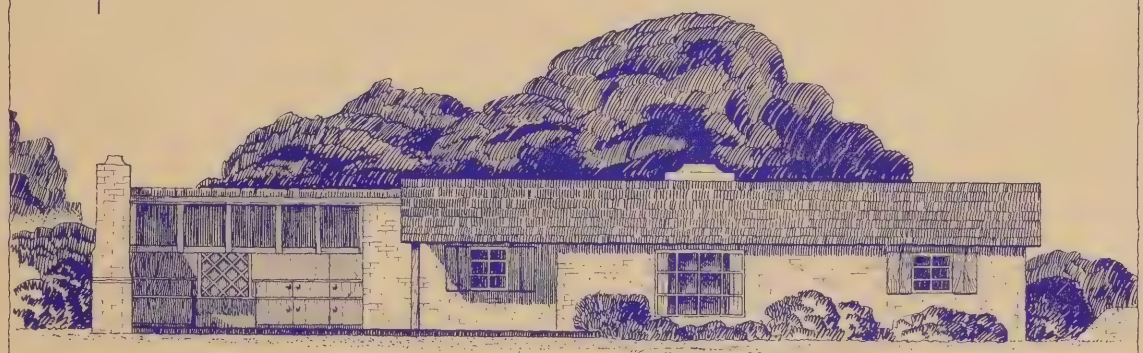
CALADOBE RANCH HOUSE



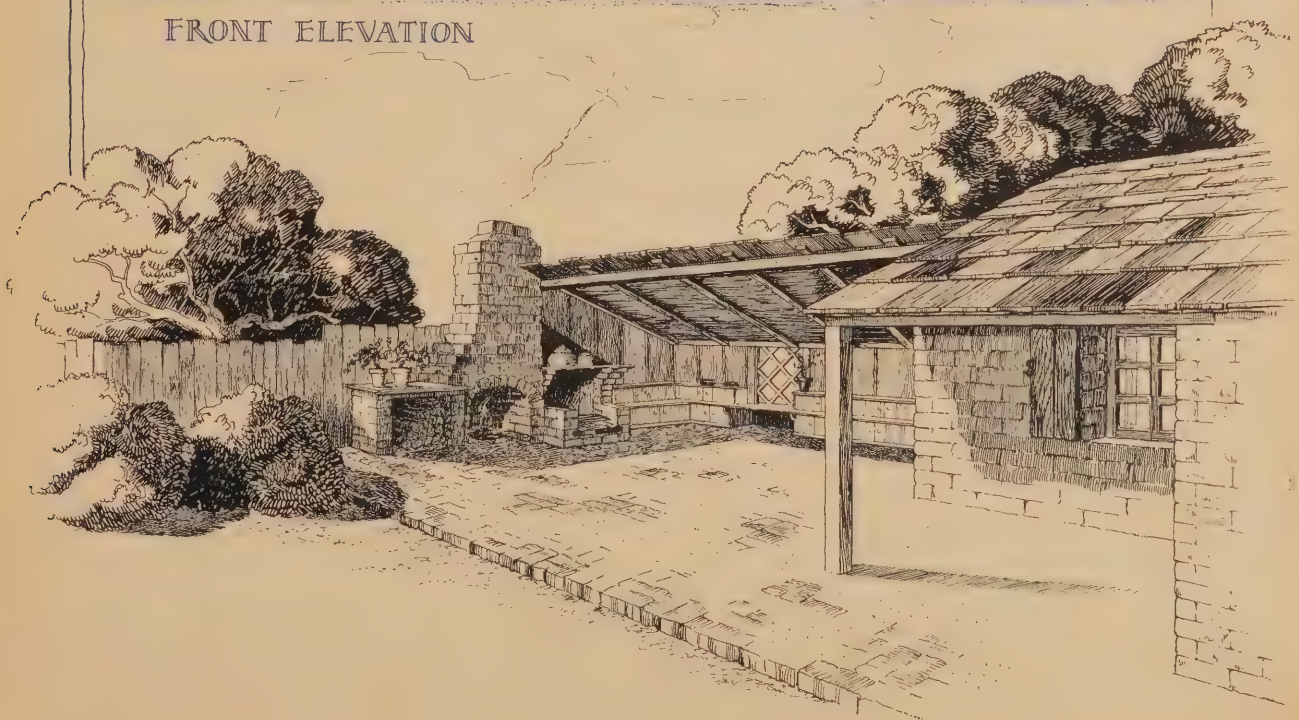


CALADOBE SUMMER COTTAGE





FRONT ELEVATION



HOW TO BUILD WITH CALADOBE

Design and Construction Data

As has been emphasized in the preceding pages of this book, Caladobe is a modern, scientifically approved adaptation of an age-old building material. It has retained all of the inherent values of the historic soil brick and has added essential qualities which conform it to the most rigid Twentieth Century building standards, when properly used.

On the following pages will be found specific structural engineering data, illustrated with detailed drawings which will suggest means of obtaining correct and enduring construction. This practical building guide, prepared under the direction of John A. Blume, structural engineer acting as consultant, is the most comprehensive presentation that has been developed for this type of building material. It includes also on pages 42 to 47, complete Specifications.

It is our sincere desire that this section prove of practical assistance to architects, builders, contractors, engineers, estimators and others interested in the design and construction of sturdy Caladobe buildings and walls. Should any additional information or aid in solving any particular problem be required, we shall be pleased to assist in every way that we can.

Data Sheet No. 101: Standard Shapes and Walls

Data Sheet No. 101 illustrates the two standard Caladobe shapes manufactured by Foster and Kleiser Company and the plain masonry walls which may be constructed from them. The builder will appreciate the minimum of handling and sorting and the resulting low costs of having only two brick shapes on a job site. In fact, for the plain 7½", 16", and 24" walls, it is necessary to use only the standard whole brick.

As noted on the Data Sheet, the mortar is 1:2½ by volume of cement and well-graded sand (most concrete sands are satisfactory), waterproofed with 1½ gallons of "Hydropel" Emulsified Asphalt per sack of cement. Tests have shown that this mortar develops excellent bond with the Caladobe Bricks, usually equal to the strength of the bricks in tension, and its use results in strong watertight walls. The use of lime or fire clay in the cement mortar, or the use of "adobe" (mud) mortars is not recommended. All further data contained in this section are based upon the use of the standard mortar as specified.

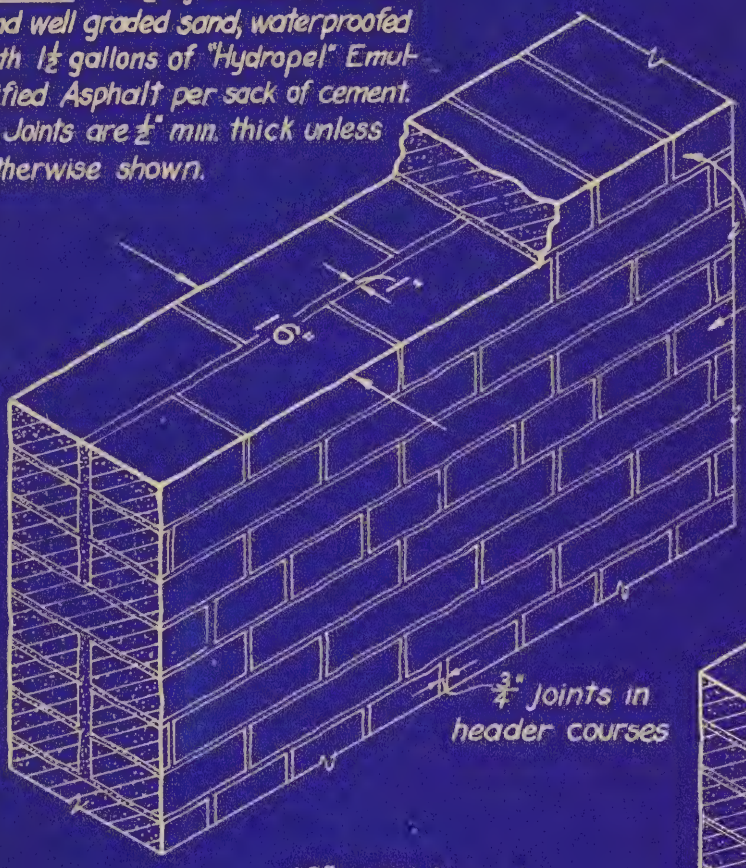
The 7½" wall is laid in a single width with the standard whole brick. The

Dining alcove in the Walter F. H. Schultz residence in Del Monte.

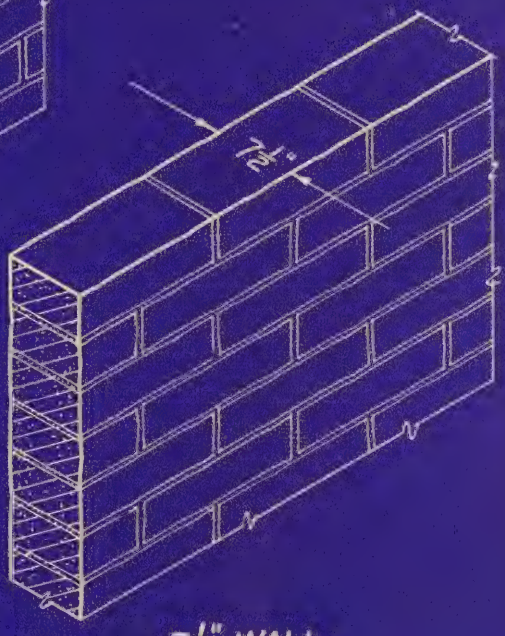
STANDARD SHAPES AND WALLS

MORTAR: 1 to 2½ by volume of cement and well graded sand, waterproofed with 1½ gallons of "Hydropel" Emulsified Asphalt per sack of cement. Joints are ½" min. thick unless otherwise shown.

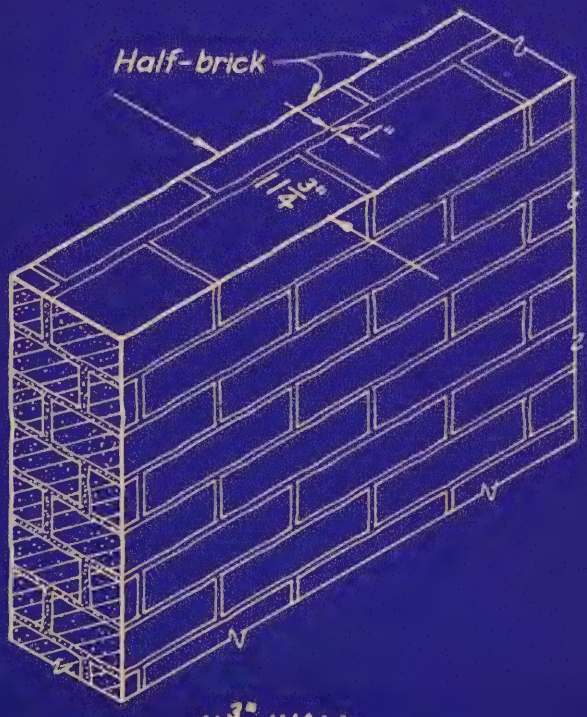
A 24" WALL may also be constructed with the standard brick.



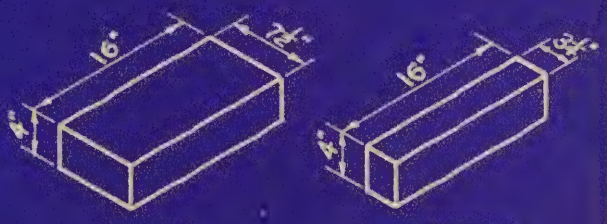
16" WALL



7½" WALL



11¾" WALL



BRICK HALF-BRICK

STANDARD SHAPES

Foster and Kleiser
COMPANY

CALADOBE BRICK

STANDARD SHAPES AND WALLS

DRAWN BY: JAB DATE: OCT. 1943

DATA SHEET No. 101

11¾″ wall is constructed with half-bricks as well as the whole bricks, and these are staggered every course as shown to provide mechanical bond. The 16″ wall construction illustrated is a common bond with headers every fourth course. The 24″ wall (not shown) is laid in common bond with a header course from each face every fourth course.

Many other types of bonds may be devised with these standard shapes for various purposes. However, the wall constructions illustrated are very effective architecturally, are simple to build, and, if desired, may be reinforced easily as shown on Data Sheet No. 102.

Data Sheet No. 102: Reinforced Wall Construction

This sheet illustrates with plan views how the various walls may be reinforced if desired without the use of any but the two standard brick shapes and without changing the appearance of the bond for any but the doubly-reinforced 16″ wall, in which the headers are shifted horizontally.

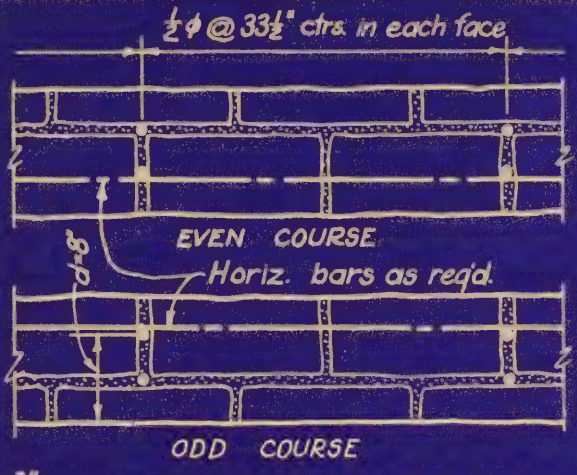
The size and spacing of the bars may, of course, be altered to suit special conditions. In the examples, the vertical bars are kept two brick lengths apart for ease of wall construction; any greater spacing would not be effective for the thinner walls. The area of vertical reinforcement shown provides approximately "balanced reinforcement" for assumed allowable unit stresses of fa = 75 and fs = 18,000 lb. per sq. in., or for fa = 100 and fs = 24,000 lb. per sq. in. (see Data Sheet No. 111, "Reinforcement Design Values" and Data Sheet No. 112, "Useful Data").

For the 7½″ wall, two half-bricks are used for alternate bricks in the odd courses to allow the placing of the vertical bars. The 11¾″ wall, reinforced with either a single or double curtain of reinforcing bars, is laid up the same as for the plain wall shown on Data Sheet No. 101. The 16″ wall with single reinforcement is also constructed as though unreinforced, but the 16″ wall with double reinforcement requires the use of half-bricks on alternate stretcher courses and a horizontal displacement of the header bricks as illustrated to permit the placing of the bars.

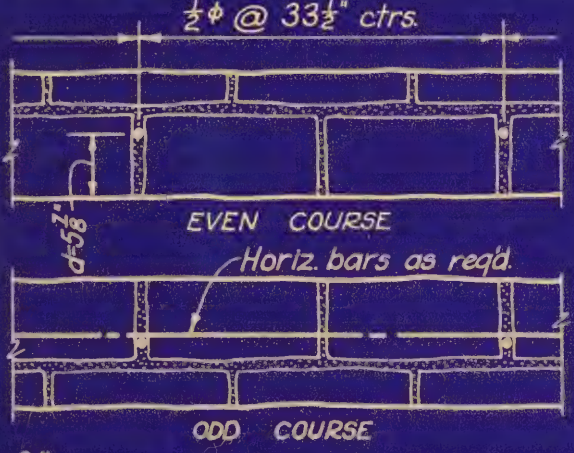
For the reinforcement to be fully effective, the bars should have a minimum coverage of ¼″ of mortar on all sides, and positive means should be taken during construction to prevent the movement of vertical bars extending upward from partially set mortar.

El Adobe Motel, Monterey Park, California.

REINFORCED WALL CONSTRUCTION



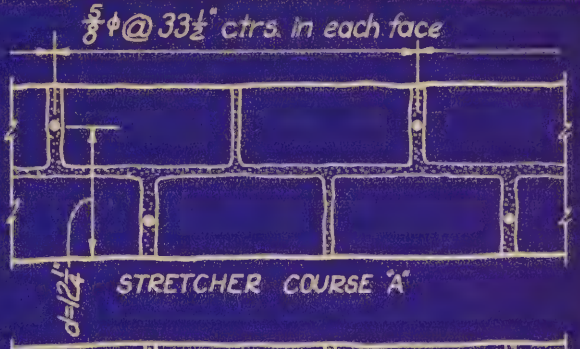
11¾" WALL—DOUBLE REINFORCEMENT

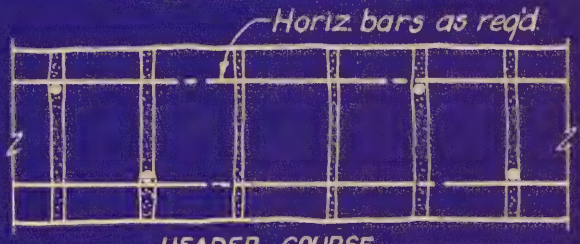


11¾" WALL—SINGLE REINFORCEMENT

7½" WALL

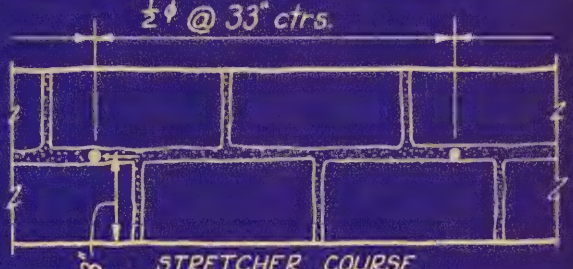
SCALE: 0 6 12 INCHES

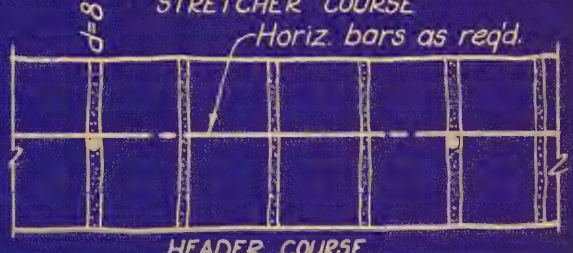




NOTE: Alternate Stretcher Courses "A" and "B" between Header Courses.

16" WALL—DOUBLE REINFORCEMENT





16" WALL—SINGLE REINFORCEMENT

GENERAL NOTES:

Bricks are uncut standard whole or half-bricks with 4" side vertical. Joints with bars are ½" wider than bars.

For design data and moment values of reinforcement shown, see Data Sheets No. 111 & 112.

Foster and Kleiser
— COMPANY —
CALADOBE BRICK

REINFORCED WALL CONSTRUCTION

DRAWN BY: JAB DATE: OCT. 1943

DATA SHEET No. 102

Whether or not reinforcement should be used in any particular wall or building depends upon the building code that may be in effect, the earthquake hazards, and other factors. In any event, the strength of the walls may be greatly increased at little extra cost by the methods illustrated.

Data Sheet No. 103: Typical Wall Section

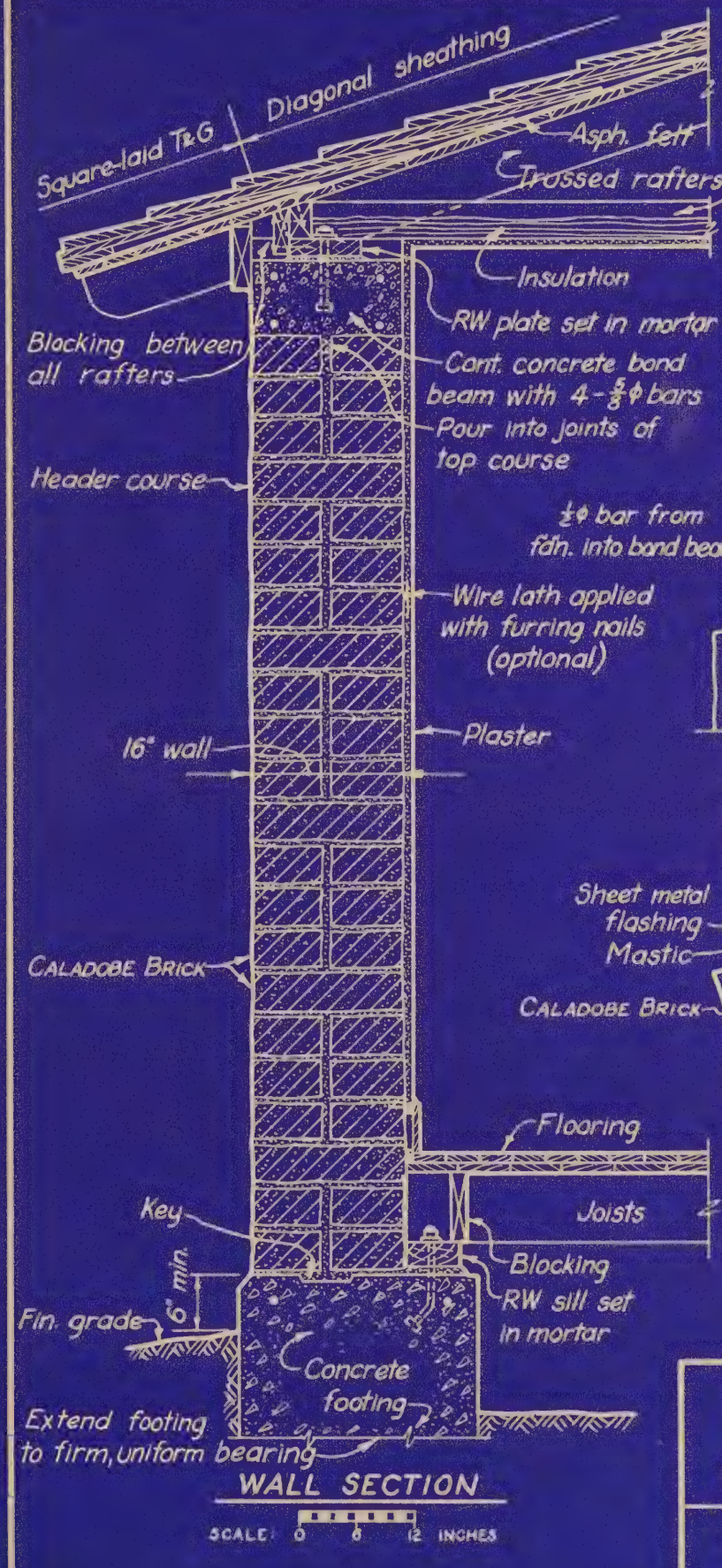
This Data Sheet illustrates a section of a building with wood flooring, 16″ plain Caladobe Brick exterior walls, and a trussed-rafter roof construction with shake roofing. The inside of the walls is finished with plaster, which may be applied directly to the wall surface, or to wire lath nailed to the Caladobe Brick with furring nails.

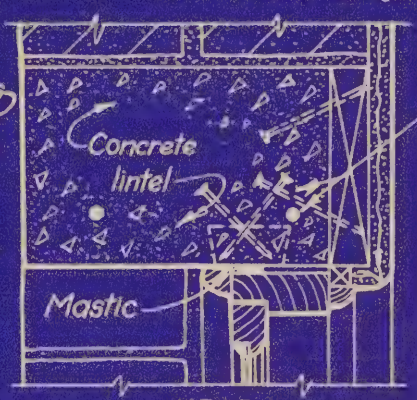
Resistance to lateral forces is obtained with the bond beam and the diagonal roof sheathing. Double blocking is indicated at the plate to obtain a well nailed and rigid connection between the sheathing diaphragm and the plate which, in turn, is securely bolted to the bond beam. About one inch of the upper part of the top course vertical joints is left without mortar so that grout may be poured into the space immediately prior to pouring the bond beam in order to form a mechanical key.

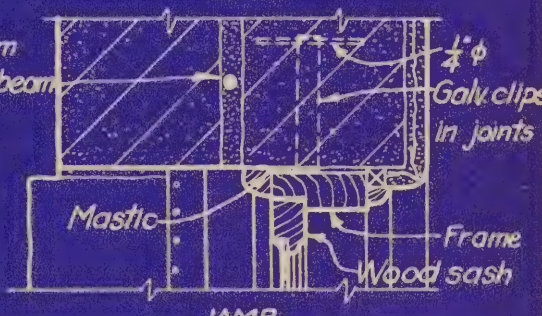
Girl Scout Building, Inglewood, California.

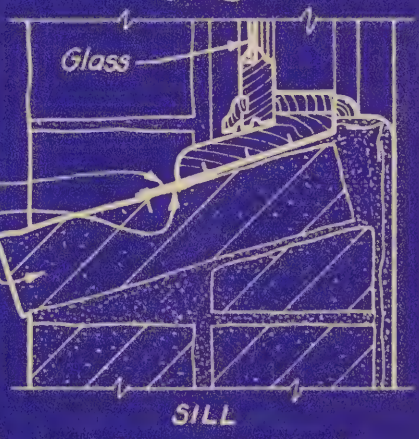
Webb School, Claremont, California.

TYPICAL WALL SECTION









WINDOW DETAILS

SCALE: 0 3 6 INCHES

Foster and Kleiser
— COMPANY —

CALADOBE BRICK

TYPICAL WALL SECTION

DRAWN BY: JAB DATE: OCT 1943

DATA SHEET No. 103

Data Sheet No. 104: Footing and Eave Details

Data Sheet No. 104 illustrates details at the footing and eave with alternate types of construction.

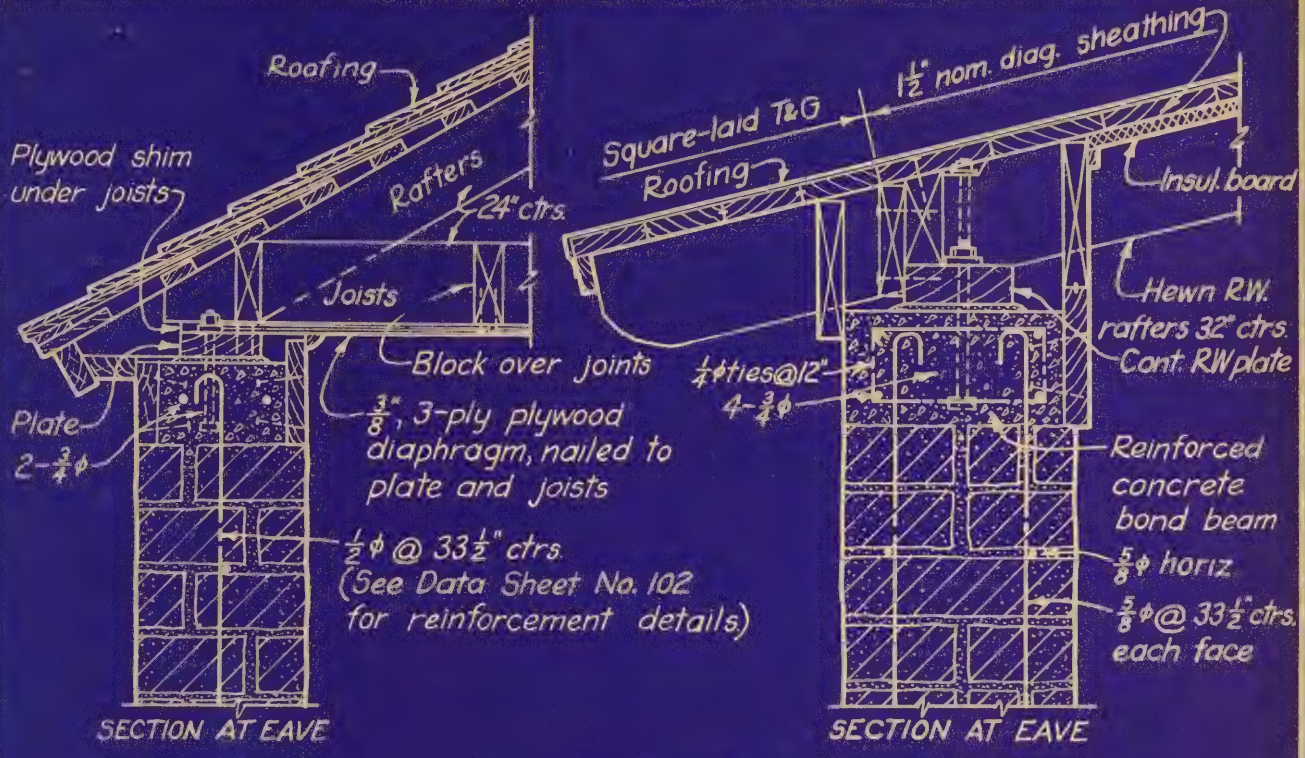
The left hand section shows a 11¾″ wall with a single curtain of reinforcement. The building floor is Caladobe Brick laid over a sand and gravel bed and covered with asphalt tile. Since the roof slope is too steep for an effective "diaphragm," the ceiling is made to function as such with plywood. Note that the plywood is nailed to the plate; a plywood shim under the joists allows the ceiling sheets to be slipped in over the plate at any time during construction. The bond beam form boards are 2″ stock and are left in place as part of the finish. The walls may be painted on either or both sides or may be plastered.

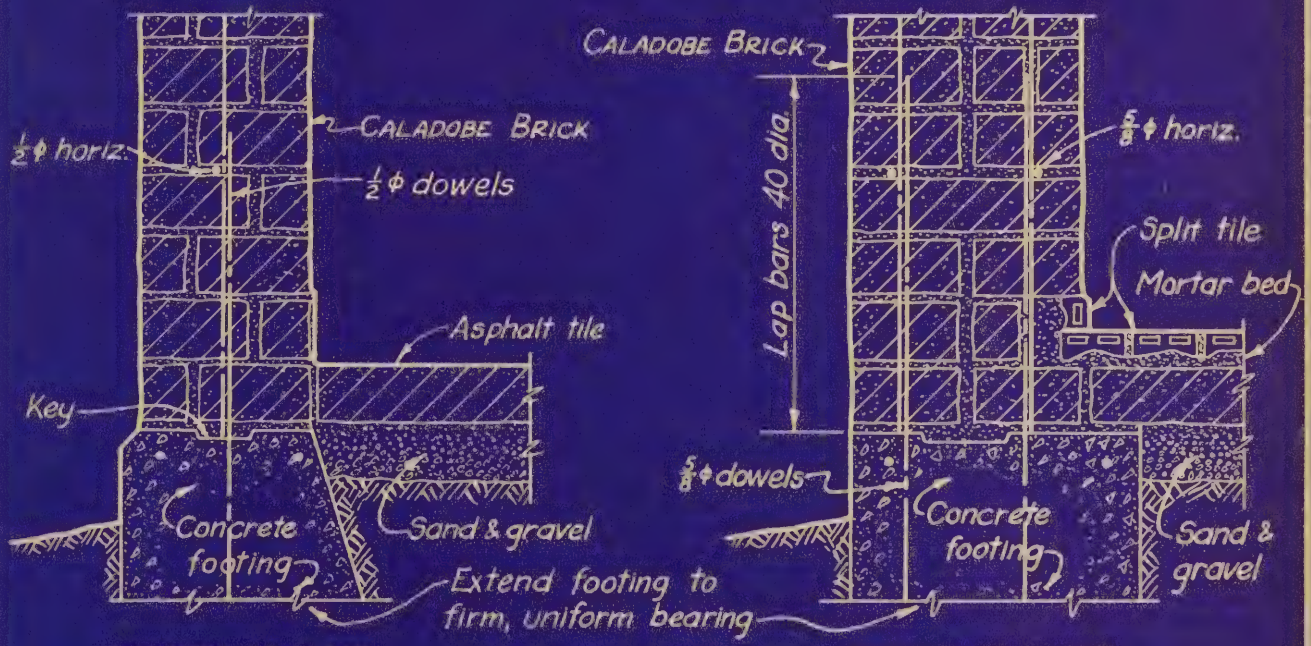
The right hand section illustrates a "massive" type of construction with exposed hewn-redwood rafters and a 16″ Caladobe Brick wall with double reinforcement. The roof sheathing is heavier than usual because of the rafter spacing.

As noted on the Data Sheet, these details as well as those shown on other Data Sheets, are only illustrations of some of the various types of construction with Caladobe Brick. Their purpose is to suggest and demonstrate certain architectural and structural features in connection with the use of the material, and not to be used as construction drawings. The wall thickness, reinforcement (if any), bolting, nailing, etc., should be determined to best suit the requirements for a particular structure.

Living room of a Santa Barbara home.

FOOTING AND EAVE DETAILS





11¾" WALL ~ STEEP ROOF

16" WALL ~ EXPOSED RAFTERS

SCALE: 0 6 12 INCHES

GENERAL NOTE

The details shown above and on other Data Sheets are only intended to illustrate some of the various types of construction with CALADOBE BRICK. The wall construction, size of members, bolting, nailing, finish, etc. for a building should be determined to suit the particular requirements.

Foster and Kleiser
COMPANY
CALADOBE BRICK

FOOTING AND EAVE DETAILS

DRAWN BY: JAB DATE: OCT. 1943

DATA SHEET No. 104

Data Sheet No. 105: Veneered Wall Section

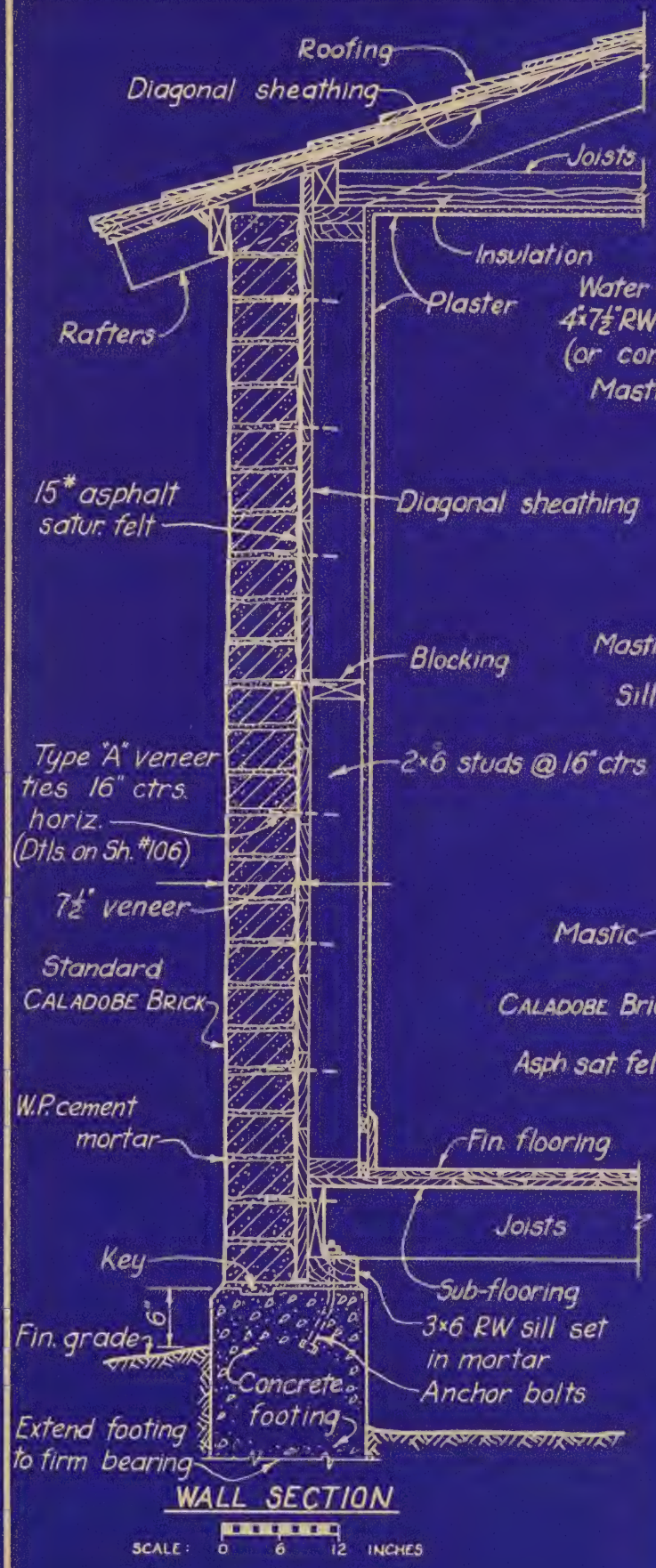
This Data Sheet illustrates a veneered construction. The wood frame of the building is constructed first, and is made entirely self-supporting. The Caladobe Brick veneer is carried on the common foundation wall and is securely fastened to the studs with ties (see Data Sheet No. 106). The mortar used is the same as recommended for masonry walls on Data Sheet No. 101.

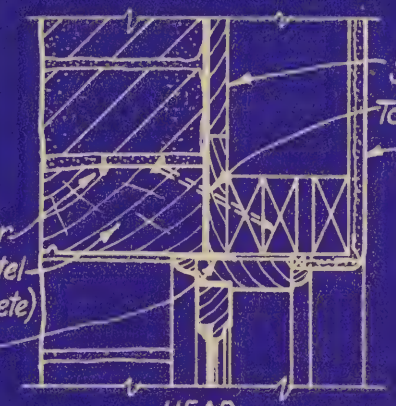
The Caladobe Brick veneer adds materially to the insulating value of a stud wall as well as lending depth to the door and window openings and creating the appearance of solid masonry construction.

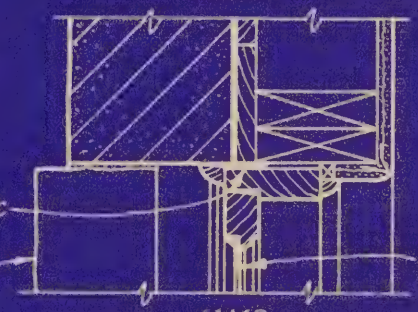
Both tile and plaster have been used attractively on the stabilized adobe walls of this bathroom. Note how the designer has taken advantage of the deep reveal beneath window for dressing table.*

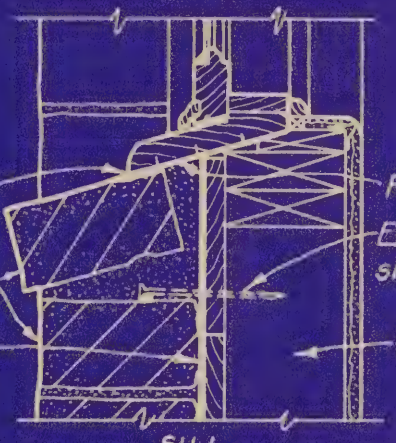
**"Deep reveal" is the professional name given to the deeply inset doors or windows of adobe buildings.*

VENEERED WALL SECTION









WINDOW DETAILS

SCALE: 0 3 6 INCHES

Foster and Kleiser
COMPANY

CALADOBE BRICK

VENEERED WALL SECTION

DRAWN BY: JAB DATE: OCT. 1943

DATA SHEET No. 105

Data Sheet No. 106: Veneer Ties

Data Sheet No. 106 suggests various types of veneer construction as well as ties. The ties have a minimum strength equal to the weight of masonry in the area formed by the 16″ horizontal and the three course (13½″) vertical spacings.

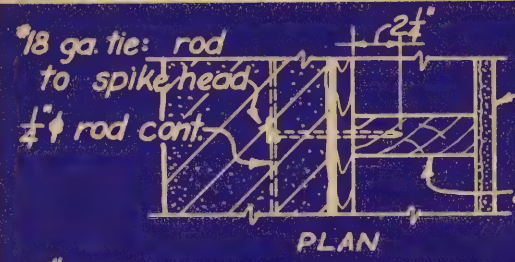
The object of tying the spike head to the horizontal rod in Type "A" and of clinching the straps and wires over the rods in the other types is to insure a positive bearing of the metal contact surfaces at the time the mortar is placed. All rods, wires, clamps, etc., in the joints are to be thoroughly embedded in the mortar.

Whether or not an air space or a mortar backing should be provided, or whether the bricks should merely be placed against the sheathing, depends upon the building code and individual preference. ***In any event, the Caladobe Brick veneer without cracks is watertight.*** The asphalt saturated felt is indicated as an additional safety factor against the penetration of moisture.

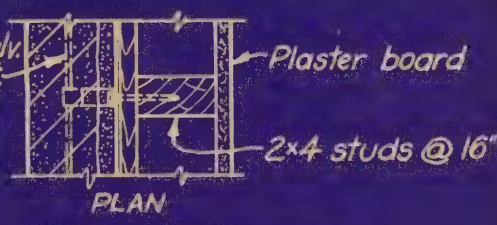
The bearing wall, wood frame or concrete, should be capable of carrying all of the wind and earthquake forces as well as the roof loading. In most codes, it is required that the veneer carry its own weight to the foundation but perform no other structural function.

Snack bar in modern stabilized adobe home. Decorative tile has been used to enhance the beauty of adobe walls.

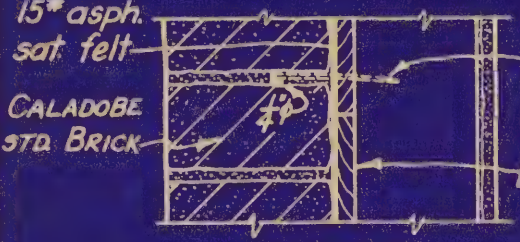
VENEER TIES



PLAN

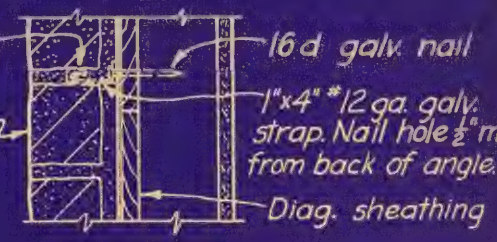


PLAN



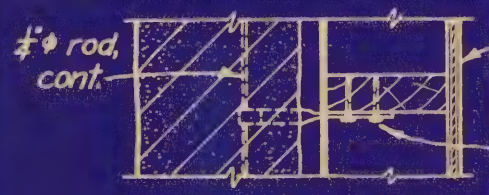
ELEVATION

TYPE "A"

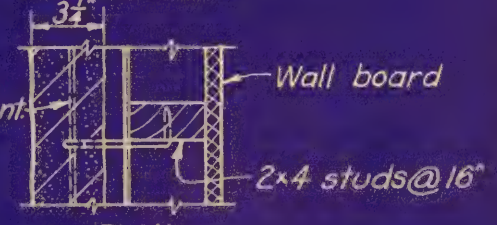


ELEVATION

TYPE "B"



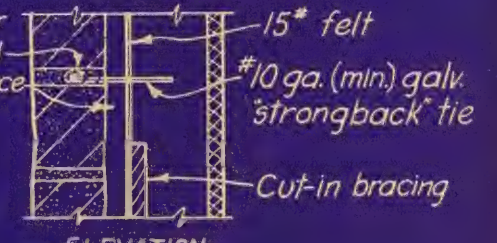
PLAN



PLAN

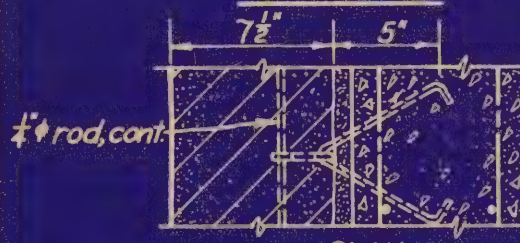
ELEVATION

TYPE "C"

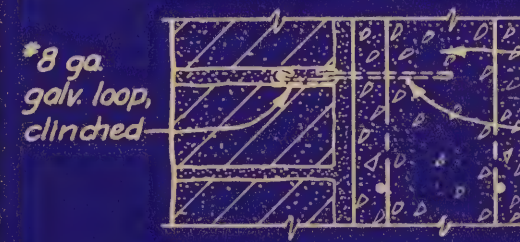


ELEVATION

TYPE "D"



PLAN



ELEVATION

TYPE "E"

·· GENERAL NOTES ··

Ties of all types are to be placed 16" ctrs. horiz. and every third course vertically. Horiz. rods to be entirely embedded in mortar and lapped 10" at splices located between ties.

Sub-bore for nails as required to prevent splitting of wood.

SCALE: 0 6 12 INCHES

Foster and Kleiser COMPANY

CALADOBE BRICK

VENEER TIES

DRAWN BY: JAB DATE: NOV. 1943

DATA SHEET No. 106

Data Sheet No. 107: Garden Walls

The walls shown on Data Sheet No. 107 are called "Garden Walls" to distinguish them from walls that form a part of, or are attached to, a building. It is now common practice in seismic areas to design free-standing or vertical cantilever walls, such as parapet walls on buildings, for lateral forces equal to the entire weight of the wall. The principal reason for this apparently severe requirement is that such walls create a hazard to people on the streets and to those who may run out from buildings at the time of severe earthquakes. Another reason is that such free-standing walls are usually relatively flexible and subject to dynamic effects which may be compensated for in design with the assumed lateral force of 100% of the wall weight.

It would seem economically unsound and technically unreasonable to design garden walls, or walls in open country where hazards to persons in earthquakes are negligible, for any such assumed loading merely because the walls are free-standing. The "Fence Walls" tabulated on Data Sheet No. 107 are calculated for 20%-gravity lateral forces which provides them with sufficient stability for wind or earthquake forces that might reasonably be expected.

The "Garden Retaining Walls" are for terracing or for holding small embankments. Larger retaining walls may be designed in Caladobe for special purposes. By stepping the wall on either or both faces, a slight economy of materials is obtained as compared to the rectangular wall section. Following are some examples in the use of this Data Sheet:

EXAMPLE (1): It is desired to build a fence wall 4′-0″ high above finished grade.

In the table under "Plain Walls" it is seen that the 11¾″ wall has a maximum "H" of 4′-6″, which, with 4″ of earth cover over the top of the foundation, leaves 4′-2″ allowable height above grade. This thickness of wall will therefore be satisfactory.

If a thinner wall is desired, the table under "Reinforced Walls" indicates that a 7½″ wall with a single curtain of reinforcement as shown on Data Sheet No. 102 will suffice. Horizontal reinforcement should be provided in the top joint and in approximately every sixth course. Since the height of the wall will be 4′-0″ plus about 4″ of fill over the foundation, it will be 1′-2″ less than the 5′-6″ tabulated maximum height. The dimensions "B" and "D" of the footing might therefore be slightly decreased. However, since this would be a rather small saving, it is not recommended unless there is a considerable length of wall to be constructed and the footing is recalculated.

EXAMPLE (2): It is desired to build a terrace or garden retaining wall 3′-0″ high. The backfill will have a slope of 4 horizontal to 1 vertical.

In the small table at the top of Data Sheet No. 107, for "h" = 4, $\theta = 14° 00'$. In the main tabulation under the column headed "θ less than 15°′", it is seen that a 16″ plain wall may be a maximum of 10 courses or 3′-8½″ high above its base. Allowing one course height of fill against the toe, the wall should be constructed 16″ thick and 9 courses high.

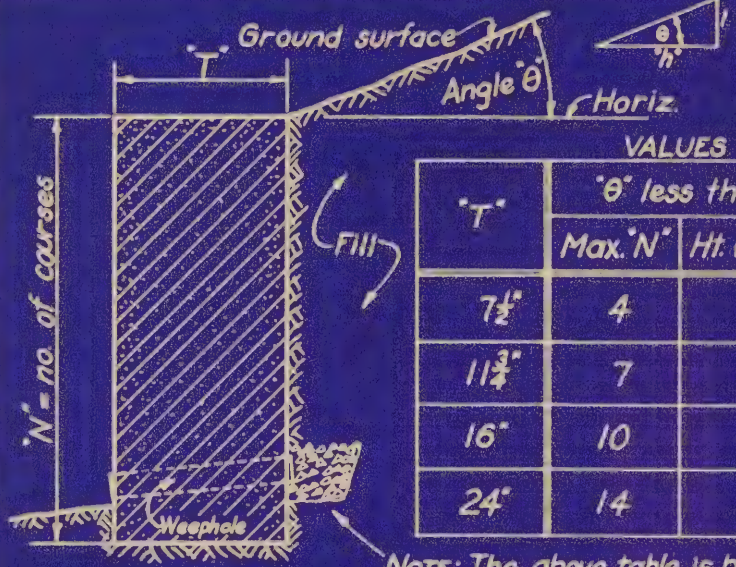
If for reasons of economy it is desired to step the back of the wall, the upper portion may have "T_3" = 7½″; therefore, the maximum value of "N_3" will be 4 courses, as shown in the table. Likewise, the maximum value of "N_2" for "T_2" = 11¾″ will be 7 courses. Thus the wall could be constructed as follows:

7½″	upper portion	4 courses
11¾″	middle portion	3 courses (7-4)
16 ″	lower portion	2 courses (9-7)
	total	9 courses

For simplicity, the 11¾″ portion might be eliminated and the wall constructed of 4 upper courses of 7½″ and 5 lower courses of 16″ thickness.

Garden wall of Burlingame, California, home.

GARDEN WALLS



SECTION OF RECTANGULAR WALL

"h"	1	1½	2	3	4
"θ"	45°	33°40'	26°40'	18°30'	14°00'

VALUES FOR PLAIN WALLS

"T"	"θ" less than 15°		"θ" between 15° and 35°	
	Max. "N"	Ht. with ½" jts.	Max. "N"	Ht. with ½" jts.
7½"	4	1'-5½"	4	1'-5½"
11¾"	7	2'-7"	6	2'-2½"
16"	10	3'-8½"	8	2'-11½"
24"	14	5'-2½"	12	4'-5½"

NOTE: The above table is based upon pervious, well drained soil. If the material is impervious or if considerable water is expected, provide drainage as indicated.

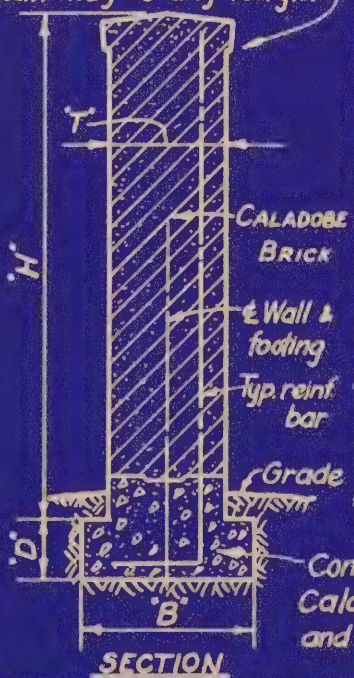
No seismic force is assumed.

Value of "N" not to exceed that tabulated above for "T"-"T₁", "N₂" for "T"-"T₂", etc.

SECTION OF STEPPED WALL

GARDEN RETAINING WALLS

"FENCE" WALLS WITH PILASTERS may be designed to withstand 20%-gravity earthquake forces with slightly thinner walls than shown below. Wall may be any length



SECTION

"T"	Plain Walls			Reinforced Walls			
	Max. "H"	"B"	"D"	No. of curtains	Max. "H"	"B"	"D"
7½"	3'-6"	1'-4"	6"	1	5'-6"	2'-0"	8"
11¾"	4'-6"	1'-8"	8"	1 2	7'-0" 9'-0"	2'-6" 3'-0"	10" 1'-0"
16"	5'-6"	2'-0"	9"	1 2	7'-6" 11'-6"	2'-9" 4'-0"	1'-0" 1'-4"

BASIS OF TABLE: Static lateral force = 20% of wall wt. @ 120 lb./cu.ft. Max. net tension in plain walls = 5⅓ lb./sq.in. "B" & "D" are for max. "H". Reinforcement as on Data Sheet No. 102; f_s = 24000 & f_a = 100 lb./sq.in. Max. O.T. Mom. = 0.6 Res. Mom. Max. soil press. = 1600 lb./sq.ft.

*RECOMMENDATION: Max. "H" = 8 "T"

Concrete footing. May be Caladobe if "D" more than "B"-"T" and "H" is 6" less than Max. "H".

"FENCE" WALLS WITHOUT PILASTERS

Foster and Kleiser
COMPANY
CALADOBE BRICK

GARDEN WALLS

DRAWN BY: JAB DATE: NOV. 1943

DATA SHEET No. 107

Data Sheet No. 108: Protective Construction

Stabilized soil bricks are one of the very few materials that have all of the qualities desirable for protective wall construction as listed on Data Sheet No. 108. These bricks have been widely used for revetments and other installations by the armed forces, essential industries, and utility companies.

This Data Sheet shows the results of Garand rifle-fire tests on Bitudobe Blocks (Bitudobe and Caladobe are identical materials) and also indicates a few of the many possible uses and installations of Caladobe Brick walls for protective purposes.

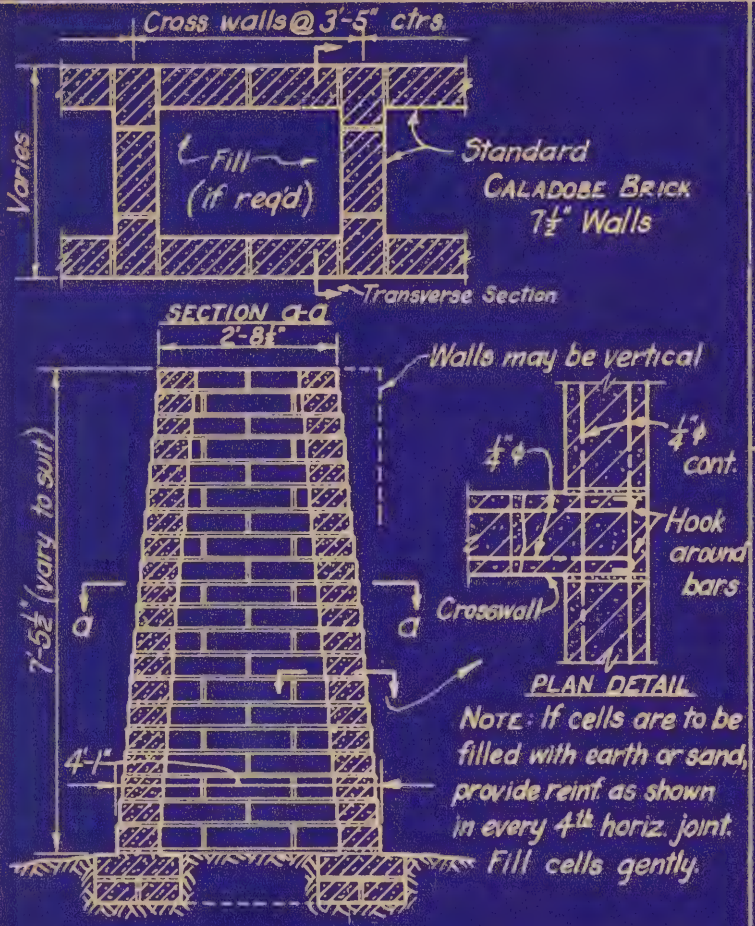
The cellular type blast wall is entirely self-supporting in any length, and has considerable blast resistance as well as resistance to penetration and fragmentation. It may be filled with earth or sand if desired for additional resistance, providing the light reinforcement indicated is placed in every fourth horizontal joint as the courses are laid.

The indoor type of air raid shelter may be easily constructed by a home owner in his own basement for the protection of his family against horizontally flying bomb splinters. Protection from vertically falling fragments that might penetrate the roof and floor of the house, as well as from possible collapse of the floor above, may also be obtained by covering the top of the walls with laminated lumber placed on edge. Of course, a strong hatchway covering, air spaces, and anchorage of the wood covering to prevent its being blasted off, all should be provided. This type of shelter is similar to one detailed with sandbag walls in "Report of the Air Raid Shelter Committee of the San Francisco Civilian Defense Council."

Caladobe Brick walls may be used for the protection of all sorts of vital installations as well as for military purposes. The walls may be of the cellular type indicated or may be any of the types shown on Data Sheets No. 101 or No. 102, depending upon the kind and amount of protection desired. In some cases, soil bricks have been placed without mortar joints up against existing fences and walls to provide protection against penetration. Such walls naturally have little strength of their own, but the existing construction provides stability and the bricks may be easily removed and reused in other locations.

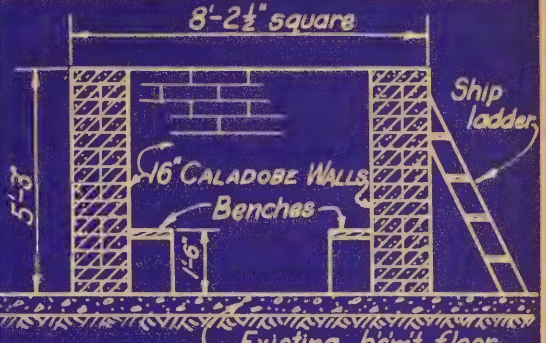
Outdoor kitchen at Girl Scout Clubhouse, Inglewood, California.

PROTECTIVE CONSTRUCTION



TRANSVERSE SECTION

CELLULAR TYPE BLAST WALL FOR THE PROTECTION OF VITAL INSTALLATIONS



INDOOR AIR RAID SHELTER

(For lateral protection from splinters)

PLAN

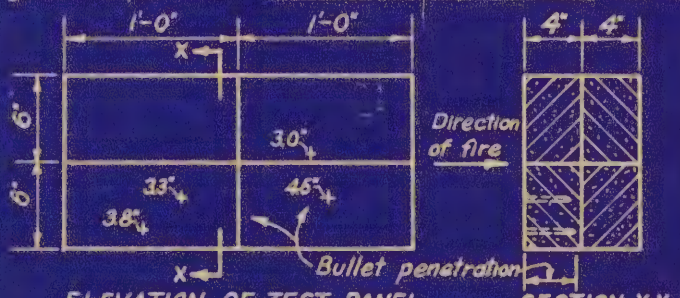
PROTECTION WITH BLAST WALLS

Data from University of Washington Engineering Experiment Station Bulletin No. 111, "Stabilized Earth Blocks for Protective Construction" by Robert Graham Hennes, July 1943:

Test Panel (Series C): 8 Bitudobe blocks as shown below. Joints filled with a paste of emul. asphalt & pulp.

Rifle: Garand, fired at 50-yard range.

Ammunition: std. M-1 ball, 0.30 calibre, 138 grain bullet, 50 grains of powder. Final condition of Panel: "Good."



ELEVATION OF TEST PANEL

SECTION X-X

GARAND RIFLE FIRE TESTS CONDUCTED AT FORT LAWTON

• • GENERAL NOTES • •

CALADOBE BRICK WALLS have all of the qualities desirable for revetments:

1. Resistance to penetration.
2. Energy absorption to prevent dangerous spalling and fracturing.
3. Strength.
4. Weather resistance.
5. Construction does not involve the use of critical materials or labor.

Foster and Kleiser COMPANY

CALADOBE BRICK

PROTECTIVE CONSTRUCTION

DRAWN BY: JAB DATE: NOV. 1943

DATA SHEET No. 108

Data Sheet No 109: Tests of Masonry Wall Panels

This Data Sheet presents a brief summary and comparison of tests conducted by the National Bureau of Standards on the structural properties of various masonry wall constructions. Only those tests that pertain to the lateral strength of the wall panels are shown since the vertical or compressive strength of all specimens is much more than ample.

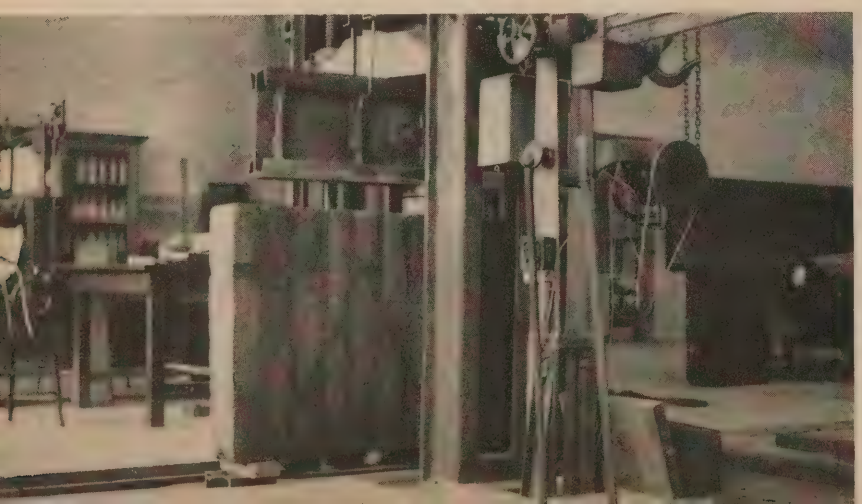
The tests are illustrated with the three diagrams at the top of the sheet, and the test results obtained by the Bureau of Standards are given in the tabulation. For those unsymmetrical wall panels that have different strength values depending upon whether the loads are applied to the inner or to the outer surface of the wall, the results for the weaker direction are tabulated.

Unfortunately for the Bitudobe Block tests (Bitudobe and Caladobe are identical materials), the mortar used in making the Bitudobe specimens was 1:1:6 parts by volume of cement, lime and sand. As noted under Data Sheet No. 101, the use of lime in the mortar is not recommended with Caladobe Brick. Subsequent tests made by the American Bitumuls Company have shown that the bond developed is greater and more reliable when the required workability of the mortar is obtained by adding cement instead of lime. Hence, it might reasonably be expected that if the 1:2½ cement-sand mortar waterproofed with Hydropel had been used in the Bureau tests that the strengths would have been even greater.

It would also be expected, because of the results of other tests conducted at Stanford University,* that the strengths of masonry laid with adobe (mud) mortar would be very unreliable.

The graphical comparison at the bottom of the Data Sheet is not by the National Bureau of Standards, but is made from their test results as indicated. The "Seismic Index" and the "Wind Index" are arbitrary values intended for comparison purposes only, and they are based upon certain assumptions regarding the action of building walls in resisting the forces of earthquakes and wind. Actually, this action is very complicated and varies with every structure. The "Wind Index" is based upon the assumption that the wind resistance of building walls is directly proportional to the results of the Transverse and Racking Load tests. The "Seismic Index" is based upon the assumption that the earthquake resistance of building walls is directly proportional to the results of the Transverse, Racking, and Impact Loading tests and inversely proportional to the weight per square foot of wall surface. Although walls are not usually struck with objects during earthquakes, they are subject to accelerations and suddenly applied loadings from roof and cross walls, all of which create an effect similar to that of the Impact Test.

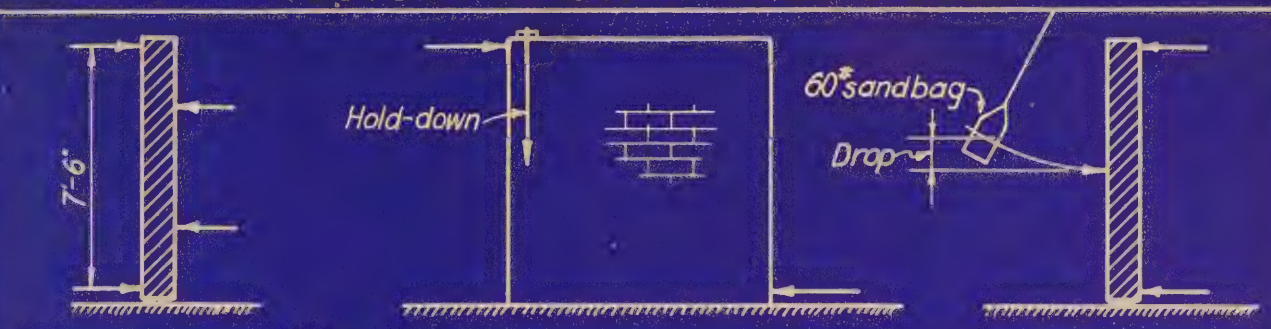
Inasmuch as it is generally expected that exterior adobe walls be four inches or more thicker than other masonry walls, and since the mortar now recommended provides better bond with Caladobe than that used in these tests, it can be seen that Caladobe Brick walls compare very favorably in lateral force resistance with other widely used masonry constructions.



Testing stabilized soil brick wall panels at Stanford University.

* See "Report of Tests and Other Data" compiled by the Research Department and copyrighted 1939 by the Pacific Coast Building Officials' Conference.

TESTS OF MASONRY WALL PANELS



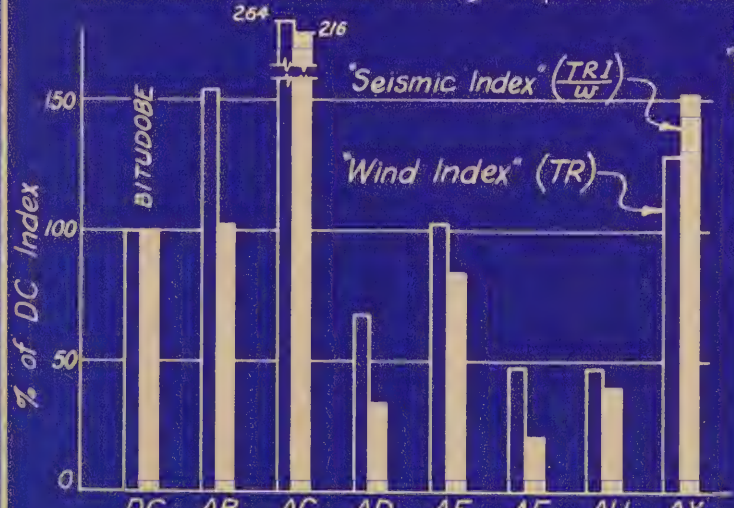
TRANSVERSE LOAD (T) RACKING LOAD (R) IMPACT LOAD (I)

NATIONAL BUREAU OF STANDARDS TESTS

PARTIAL TABULATION OF TEST DATA

From Report	Structural Symbol	Type of Wall	Wall thickness	Wt./sq.ft. (w)	Average Test Results		
					T	R	I
			inches	lbs.	lbs/sq.ft.	Kips/ft.	Ft. of drop
BMS 78	DC	Bitudobe Block	11 3/4	117	79.6	2.94	6.7
BMS 5	AB	Medium-Strength Brick Commercial workmanship	8 1/16	73.9	47.9	*6.25	2.8
do.	AC	Medium-Strength Brick Excellent workmanship	8 3/16	78.9	82.2	*6.25	3.7
do.	AD	Structural Clay Tile on End. Excell. workmanship	8 1/16	42.6	38.7	4.02	1.2
do.	AE	Structural Clay Tile on Side. Excell. workmanship.	8	38.9	63.9	3.74	1.8
do.	AF	Stone Concrete Block. Excellent workmanship	7 13/16	54.5	34.3	3.18	1.3
BMS 24	AU	Brick-Tile Cavity. 2" air space, steel ties	9 3/4	62.3	21.5	5.16	3.0
BMS 21	AX	Concrete-Block Cavity 2" air space, steel ties.	10	44.1	49.8	6.01	3.0

*Specimens had not failed at end of tests - values made 7.5 for diagram below. Wall AX laid with 1:1/4:3 mortar, all others with 1:1:6 (by vol.) cement-lime mortar. Subsequent tests by the American Bitumuls Co. have shown that the bond to Bitudobe is vastly improved with more cement and no lime.



GRAPHICAL COMPARISON OF WALLS

NOTE: The "Seismic Index" and the "Wind Index" are arbitrary values used here for comparison purposes only.

"Bitudobe Block" and "Caladobe Brick" are identical materials.

Tests and BMS reports are by the National Bureau of Standards.

Foster and Kleiser COMPANY

CALADOBE BRICK

TESTS OF MASONRY WALL PANELS

DRAWN BY: JAB DATE: OCT. 1943

DATA SHEET No. 109

Data Sheet No. 110: Lateral Force Design Elements

This Data Sheet is intended to illustrate certain basic principles of design and construction which have been found to be effective in making low buildings of any material more resistant to lateral forces caused by wind or earthquake. It also presents a few rules that apply more particularly to Caladobe Brick structures. The information given is by necessity very brief and general in nature and is offered as an aid to, rather than a substitute for, proper design by qualified architects and engineers. A building code or regulation in force at any particular locality must, of course, be followed, and for important structures experienced professional advice and analysis is recommended.

It is realized that some localities in which Caladobe buildings may be constructed have little or no seismic history, and that ordinary wind forces have practically no effect on a well built Caladobe structure. The problem of the design forces to be assumed must be left to the local building code, the individual designer, and the owner.

Data Sheet No. 110 and the following supplementary material apply particularly to seismic areas which, in a general way, include most of the western part of the United States.

Scientifically manufactured Caladobe Bricks laid in waterproofed cement mortar constitute a different masonry than the old mud-mortar adobe that has been racked and wrecked by earthquakes for centuries. A Caladobe Brick building that has been well designed and constructed according to present knowledge and the recommendations of the manufacturer will possess ample resistance to reasonably expected lateral forces, be waterproof, and still have all of the charm and other features of old adobe construction.

The principles involved in the design of a modern adobe building to resist lateral forces are no different than for other constructions of one or two stories. A great deal of research has been undertaken and many technical articles have been written since the 1933 Long Beach disaster. The essential thing is to tie the various elements of the structure together so that the building will act as a unit and remain a unit. The forces are transmitted along various paths according to relative rigidities: all the connections along these paths must be capable of passing the forces along. The importance of other elements in addition to the walls, and of the connections between them and the walls cannot be overemphasized. Usually these features can be incorporated into a building at little or no extra expense over more careless methods.

As with any material, considerable inherent resistance to lateral forces can be obtained right in the plan layout. In this regard, the following ideal features are desirable, although very often not possible or even necessary:

1. Plan of the building to be basically rectangular without protuberances such as thin wings. (Odd shapes may be structually separated to form rectangles.)
2. Masonry walls and their openings to be symmetrical about the center-lines of the building.
3. Cross walls to be so located as to avoid long side walls.

Where unreinforced walls are constructed, considerable extra resistance to lateral forces may be obtained by placing vertical bars from the foundation into the bond beam at corners and at door and window jambs. Another "extra strength" feature that has been employed is to place small rods or twisted wires in the mortar of every fifth or sixth horizontal joint. These should be straight, well lapped, and continuous around all corners to be effective.

The thickness of the wall and whether or not it should be reinforced depend upon

LATERAL FORCE DESIGN ELEMENTS

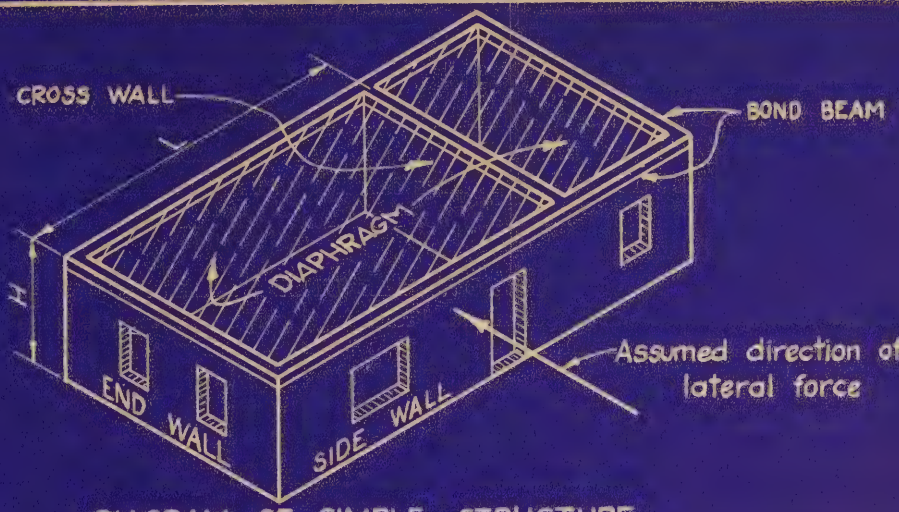


DIAGRAM OF SIMPLE STRUCTURE

ELEMENT OF STRUCTURE	PRINCIPAL FUNCTIONS UNDER LATERAL FORCES	REMARKS ABOUT DESIGN AND CONSTRUCTION
DIAPHRAGM	To act as a horizontal girder or plate in distributing forces from roof, ceiling and side walls to the end and cross walls. To do this, and to relieve the side walls of carrying horizontal roof and ceiling forces as vertical cantilevers, the diaphragm must have rigidity as well as strength, and must be securely fastened to all the walls through the plate and bond beam.	If the roof is of 12:6 slope or flatter, its rafters may be diagonally sheathed to function as the diaphragm. Square-laid sheathing is generally too flexible to be effective. If the roof is steeper than 12:6, a ceiling construction of well-nailed plywood may be used. A steep roof with no ceiling necessitates a special analysis to make the bond beam and the walls self-sufficient.
BOND BEAM	To act as a tie along the top of the walls, thus giving them considerable extra strength as vertical beams in resisting foundation settlements and other irregular or concentrated loadings. To give the walls additional lateral strength along their tops to resist normal forces and concentrated reactions from plate anchors, rafters, etc.	The concrete bond beam must have considerable tensile strength continuously around the top of all walls and corners, and it should be well bonded to the top course of masonry. A minimum area of reinforcement equal to 0.0007 times the entire area of the Caladobe wall section is recommended.
SIDE WALLS	To carry the normal forces down to the foundation, up to the bond beam and diaphragm, or sideways to the end and cross walls, depending upon the ratio of L/H, the area and arrangement of openings, and the rigidity of the diaphragm. To resist torsional forces caused by the rotation of the building.	Design the structure as a whole for lateral forces in any direction equal to 10% of the dead weight. Design walls for 20% of their own weight as a loading normal to the face. Minimum thickness exterior walls 11¾". Reinforcement is recommended. Concrete lintels are recommended. Wall openings should have a total width in any wall of less than 40% of wall length. Avoid corner windows. Ratio of height to width of piers between openings to be about equal. All mortar to be 1:2½ cement and well-graded sand mortar, waterproofed.
END WALLS	To receive the forces from the diaphragm, the bond beam, and the side walls and to transmit them down to the foundation. To resist torsional forces caused by the rotation of the building.	
CROSS WALL	Same as the end walls except that the value in resisting torsional forces is usually small.	
PARAPET WALLS & CHIMNEYS	To carry themselves as vertical cantilevers.	Design and reinforce for horizontal force equal to their own weight.
FOUNDATION	To receive forces from the walls and to transmit them to the ground. To support the walls uniformly at all times so that no cracks develop with consequent loss of wall strength.	Extend to firm, uniform bearing of proper intensity for soil. Provide key for wall mortar. Top and bottom horizontal reinforcement is recommended.

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LATERAL FORCE DESIGN ELEMENTS

DRAWN BY: JAB DATE: OCT. 1943

DATA SHEET No. 110

too many factors to be established here in this general consideration. A minimum thickness of 11¾″ for exterior walls is given in the table on the Data Sheet. In general, the walls should be about four inches thicker than in ordinary masonry. In many cases the 16″ wall is preferable not only for its structural value but for architectural, thermal and acoustical advantages.

ALLOWABLE UNIT STRESSES

The following values are recommended for design purposes when the walls are constructed according to Data Sheets No. 101 and No. 102:

	Vertical Loads Only	Combined Vertical Loads and Lateral Forces
Compression—axial	60 lb. per sq. in.	80 lb. per sq. in.
Compression—extreme fiber in flexure	75 " " " "	100 " " " "
Tension—axial	0 " " " "	0 " " " "
Tension—extreme fiber in flexure, plain sections	4 " " " "	5⅓ " " " "
Shear	4 " " " "	5⅓ " " " "
Reinforcing steel:		
Tension	18,000 " " " "	24,000 " " " "
Bond, plain bars	60 " " " "	80 " " " "
Bond, deformed bars	75 " " " "	100 " " " "
Modulus of Elasticity	200,000 lb. per sq. in.	
Modulus of Rigidity	80,000 " " " "	

Note—The assumption of straight line stress distribution in flexure, whether for plain or reinforced sections, is not strictly correct for this material. However, it is on the side of safety and is considered proper for all practical purposes since it corresponds with the reduction of test data.

Data Sheet No. 111: Reinforcement Design Values

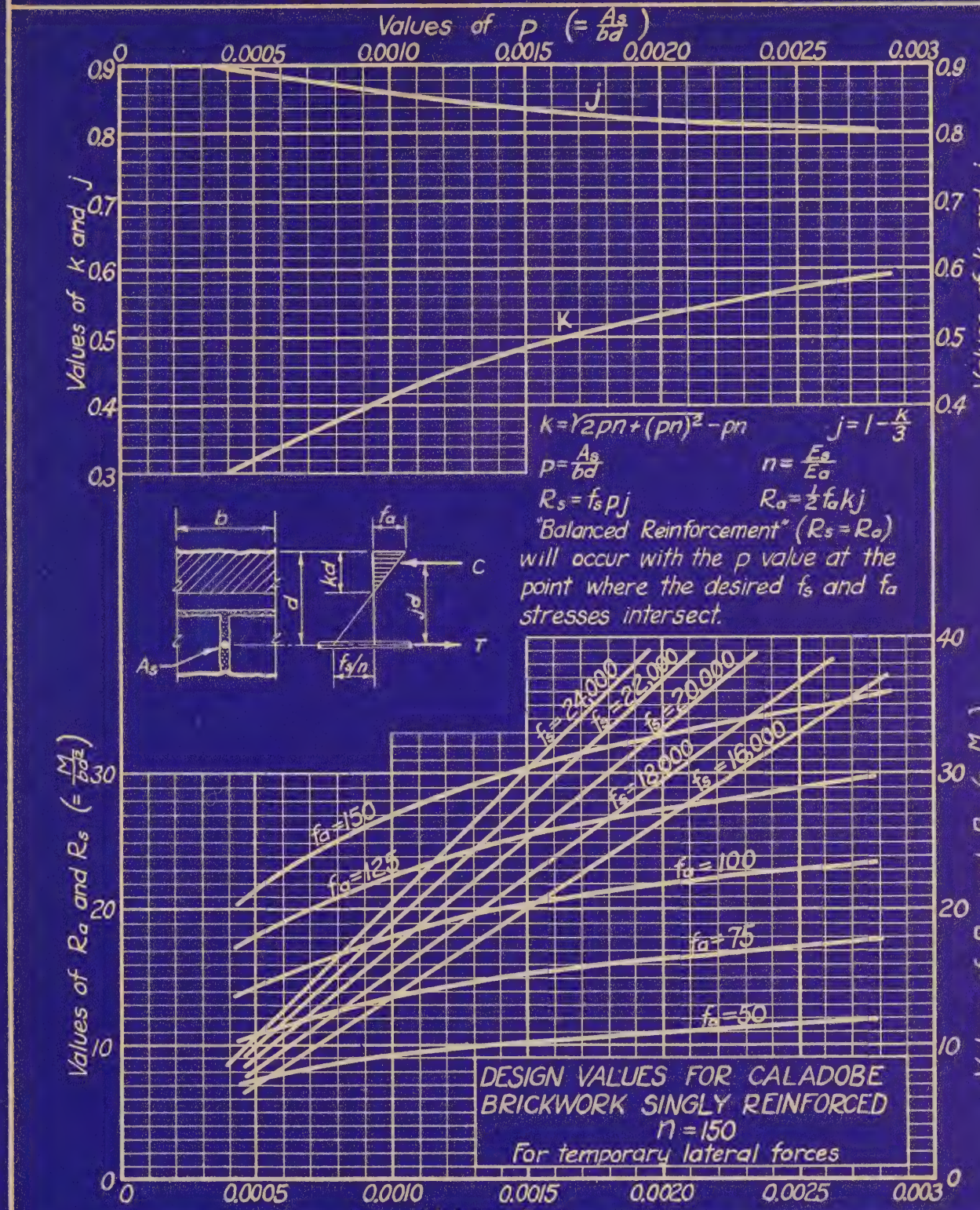
Data Sheet No. 111 contains curves and formulas for use in designing and computing stresses in reinforced Caladobe Brick masonry. The formulas are the same as those conventionally used for reinforced concrete, but the curves are drawn for values applicable to Caladobe Brick. The diagram is similar to those shown in standard concrete text books such as "Principles of Reinforced Concrete" by Turneaure and Maurer.

In presenting these data it is realized that the same arguments that apply against the basic assumptions in concrete design will apply here to a somewhat greater degree since adobe is more semi-plastic than concrete. However, it is believed proper to use the same basic formulas for the reasons given below the table of allowable unit stresses in the text for Data Sheet No. 110.

The modulus of elasticity of adobe varies with stress and also depends upon

Van's Cafe, Salome, Arizona. Thick stabilized soil brick walls provide coolness in desert heat.

REINFORCEMENT DESIGN VALUES



NOTES: These values are based upon the same assumptions and are to be used as in concrete design.

Variations of E_a with unit stress are neglected with slight error for lateral force design.

All units are in pounds and inches.

The value of the compression steel in doubly-reinforced walls is small and may be neglected.

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REINFORCEMENT DESIGN VALUES

DRAWN BY: JAB DATE: OCT. 1943

DATA SHEET No. 111

whether it is measured under tension or compression. This is also true of other masonry materials but to a lesser degree. Since the value of Ea = 200,000 lb. per sq. in. has already been established as a "good average," it has been used here. This Data Sheet is based upon n = 150, or Ea = 200,000. Actually, considerable variations from the assumed value of n do not seriously affect design results in the working range of this diagram.

Data Sheet No. 112: Useful Data

This Data Sheet contains tables of information useful to architects, engineers, contractors, and estimators in connection with Caladobe Brick construction. It is believed that the tables are self-explanatory.

Under "Values for One-Foot Length of Plain Wall," weights are given per square foot of wall surface for both 110 and 120 pounds per cubic foot weight of masonry, because the weight of adobe brick varies slightly depending upon the soil from which it is made. These two values should cover all conditions.

The table "Brickwork Dimensions" is based upon ½ inch joints as noted. When reinforcement is used, the joints containing bars are made wider to provide ¼ inch mortar cover around the bar. Thus, by adding the sum of the bar diameters within a run to the tabular value for plain walls, the total dimension is obtained.

Natural (unpainted) stabilized adobe of Mr. and Mrs. F. C. Price, Palo Alto, California.

Patio entrance to the Paul Beuter home, Burlingame, California.

USEFUL DATA

BRICKWORK DIMENSIONS

STD. BRICKS ~ ½" JOINTS

No. of bricks	Height	Length
1	4½"	1'-4½"
2	9"	2'-9"
3	1'-1½"	4'-1½"
4	1'-6"	5'-6"
5	1'-10½"	6'-10½"
6	2'-3"	8'-3"
7	2'-7½"	9'-7½"
8	3'-0"	11'-0"
9	3'-4½"	12'-4½"
10	3'-9"	13'-9"
11	4'-1½"	15'-1½"
12	4'-6"	16'-6"
13	4'-10½"	17'-10½"
14	5'-3"	19'-3"
15	5'-7½"	20'-7½"
16	6'-0"	22'-0"
17	6'-4½"	23'-4½"
18	6'-9"	24'-9"
19	7'-1½"	26'-1½"
20	7'-6"	27'-6"
21	7'-10½"	28'-10½"
22	8'-3"	30'-3"
23	8'-7½"	31'-7½"
24	9'-0"	33'-0"
25	9'-4½"	34'-4½"
26	9'-9"	35'-9"
27	10'-1½"	37'-1½"
28	10'-6"	38'-6"
29	10'-10½"	39'-10½"
30	11'-3"	41'-3"
40	15'-0"	55'-0"
50	18'-9"	68'-9"
60	22'-6"	82'-6"
70	26'-3"	96'-3"
80	30'-0"	110'-0"
90	33'-9"	123'-9"
100	37'-6"	137'-6"

For a reinforced wall, add the sum of bar dias. within a run to the above.

QUANTITY DATA FOR WALLS WITH ½" JOINTS

Item	Wall Thickness 7½"	11¾"	16"	24"
Brick – no. per sq. ft. of wall surface	1.939	1.939	3.879	5.818
Half-brick: no. per sq. ft. wall surface	—	1.939	—	—
Mortar – cu. ft. per sq. ft. wall surface	0.086	0.207	0.256	0.384
Sq. ft. wall laid with 1000 brick	515.73	—	257.80	171.88
Sq. ft. wall laid with 1000 B. & 1000 ½ B.	—	515.73	—	—
Cu. yd. mortar per 1000 brick	1.65	—	2.44	2.44
Cu. yd. mortar per 1000 B. & 1000 ½ B.	—	3.96	—	—

The above values are net – allow for waste.

VALUES FOR ONE-FOOT LENGTH OF PLAIN WALL

T ~ inches	Area ~ sq. in.	Wt. @ 110 lb./cu. ft. lb./sq. ft.	Wt. @ 120 lb./cu. ft. lb./sq. ft.	Shear value @ 5⅓ lb./sq. in. lbs.	Moment of Inertia* in.⁴	Section Modulus* in.³	Mom. res. @ f = 5⅓ lb./sq. in.* ft.-lbs.
7½	90	68.8	75.0	480	422	112.5	50.0
11¾	141	107.8	117.5	752	1622	276.1	122.7
16	192	146.6	160.0	1024	4096	512.0	227.6
24	288	220.0	240.0	1536	13,824	1152.0	512.0

* Normal to wall

VALUES FOR REINFORCED WALLS

T	No. of reinf. curtains	Vertical bars in each curtain	"p"	Mom. of res. in ft-lbs.* per foot of wall f_a=75 f_s=18,000	f_a=100 f_s=24,000	Lbs. of steel** per sq. ft. of wall surface
7½"	1	⅜ ϕ @ 33½"	0.00088	183	243	0.28
11¾"	1	½ ϕ @ 33½"	0.00100	471	625	0.49
11¾"	2	½ ϕ @ 33½"	0.00073	750	970	0.98
16"	1	½ ϕ @ 33"	0.00073	750	970	0.49
16"	2	⅝ ϕ @ 33½"	0.00075	1770	2320	1.53

* Assuming horiz. bars @ 32" ctrs. same size as vert. – Allow for laps.

REINF. BAR DATA

Size	Area	Area per ft. spaced @ 8¼"	16¾"	33½"	41¼"
¼ ϕ	.049	.071	.035	.018	.014
⅜ ϕ	.111	.162	.080	.040	.032
½ ϕ	.196	.285	.140	.070	.057
½ □	.250	.364	.179	.090	.073
⅝ ϕ	.307	—	.220	.110	.090
¾ ϕ	.442	—	—	.158	.129

Std. brick 4" × 7½" × 16" Vol. = 0.278 cu. ft.
Half-brick 4" × 3¾" × 16" Vol. = 0.120 cu. ft.

Foster and Kleiser
— COMPANY —
CALADOBE BRICK

USEFUL DATA

DRAWN BY: JAB DATE: NOV. 1943

DATA SHEET No. 112

Suggested Specification for

CALADOBE BRICK MASONRY CONSTRUCTION

1.0 GENERAL

1.1 SCOPE: This specification includes requirements for materials and workmanship in connection with the construction of Caladobe Brick Masonry walls and buildings. It is intended to be a guide for the preparation of specifications for actual construction.

1.2 "CALADOBE BRICK" is the registered trade name for stabilized soil bricks manufactured by Foster and Kleiser Company. All bricks are manufactured in compliance with the American Bitumuls Company specifications F-6 and the requirements of the PCBOC Uniform Building Code, 1943 Edition, Section 2411. Standard size of Caladobe Brick is 4″x7½″x16″.

1.3 DESIGN OF BUILDINGS shall be in accordance with the building code in effect at each particular locality, and with the recommendations of Foster and Kleiser Company as set forth on Data Sheet No. 110 and the supplementary text. The structural analysis, preparation of working drawings and specifications, and the supervision of construction should be performed by qualified architects and structural engineers.

2.0 MATERIALS

2.1 BRICKS shall be Caladobe Bricks manufactured by Foster and Kleiser Company.

2.2 CEMENT for mortar shall be Portland Cement meeting A.S.T.M. requirements.

2.3 WATER for mortar shall meet Public Health drinking water standards, without excess alkali salts. Contaminated water shall not be used without testing and approval.

2.4 SAND for mortar shall be well graded masonry mortar sand, with a fineness modulus of not less than 2.0. It shall be clean, sharp, and free from organic matter, acids, alkalis, soluble salts, and other deleterious substances. Ocean or beach sand shall not be used.

2.5 ADMIXTURE for mortar shall be Bitumuls Concrete Admix Emulsified Asphalt (Hydropel) as manufactured by the American Bitumuls Company.

2.6 REINFORCEMENT BARS shall be deformed steel bars meeting A.S.T.M. requirements.

2.7 WIRE FOR REINFORCEMENT shall be twisted cold drawn steel wire.

3.0 MORTAR FOR LAYING BRICKS

3.1 PROPORTIONS shall be one (1) part cement and two and one-half (2½) parts sand (by volume), in which "Hydropel" Emulsified Asphalt shall be incorporated in the ratio of one and one-half (1½) gallons to each sack of cement. All references to "mortar" herein shall mean mortar thus treated.

3.2 LIME shall not be used in the mortar.

3.3 FIRE-CLAY shall not be used in the mortar.

3.4 PARTIALLY set mortar shall not be used.

Arizona State Teachers College (B. B. Moeur Activity Building), Tempe, Arizona. Stabilized adobe building, stuccoed to conform with other buildings in group.

Construction pictures of one of the buildings erected for the Fresno County Fair Association, Fresno, California.

Note the reinforced concrete frame with stabilized soil brick used as a filler wall between columns. The reinforced concrete frame is entirely concealed by the outside courses. Permanence, temperature control, and beauty at minimum cost.

3.5 COMPRESSIVE strength of mortar shall not be less than 1500 pounds per square inch in 7 days.

3.6 CAPILLARY ABSORPTION of mortar shall not exceed 2% of dry weight in 7 days.

4.0 TREATED CONCRETE

4.1 TREATED CONCRETE shall be used for all lintels and bond beams, and elsewhere as indicated on the drawings.

4.2 PROPORTIONS of rock, sand, and cement and water shall be proper for the strength and workability required and "Hydropel" Emulsified Asphalt shall be incorporated into the mixture in the proportion of one and one-half (1½) gallons to each sack of cement. All references to "treated concrete" herein shall mean concrete thus treated.

5.0 FOUNDATIONS

5.1 FOOTINGS FOR BUILDING WALLS shall be Portland Cement Concrete proportioned for adequate strength, placed on sound bearing, and reinforced with longitudinal bars.

5.2 FOUNDATION WALLS FOR BUILDINGS shall be Portland Cement Concrete carried at least 6 inches above finished earth grade and reinforced with longitudinal reinforcement. Where required on the drawings, the uppermost 6 inches of concrete shall be treated concrete as specified in paragraph 4.2.

5.3 DEPRESSED KEYS for mortar shall be cast in the top of all foundation walls. Such keys shall be approximately ¾″ deep, one-third the width of the wall, and shall be centered with the wall.

5.4 DOWELS shall be extended at least 40 diameters above the top of the foundation walls for splicing with wall reinforcement. Provide one dowel of equal diameter for each vertical wall bar.

6.0 CONSTRUCTION OF WALLS

6.1 GENERAL: Walls may be plain, reinforced with one or two curtains of bars running horizontally and vertically, or may have occasional reinforcement such as horizontal wires and vertical bars at corners and at door and window jambs. (See Data Sheet No. 110 and supplementary text.)

6.2 CLEANING: Before laying bricks, the mortar keys and the top of the foundation walls shall be cleaned of all laitance and loose dirt, and wet down to insure bond with the mortar. Bricks shall be cleaned of adhered paper, loose sand, dust and other surface contamination, and shall be wetted just prior to laying.

6.3 LAYING BRICKS: Mortar shall be spread on the top of the foundation wall to fill the mortar keys and thoroughly bed the first course of bricks. Bricks shall then be laid up in courses around the walls and partitions as shown on Data Sheets No. 101 and No. 102, and as shown on the working drawings, 16″ and 24″ walls shall have a header course every fourth course. Bricks in each course shall overlap to the center of the bricks in the course below. At all corners and intersections with partition walls and cross walls, bricks shall be interlapped for strength and keying action.

6.4 MORTAR JOINTS shall be not less than ½″ thick. All vertical and horizontal joints in the masonry shall be completely filled with mortar. Vertical mortar joints shall be rodded. Where reinforcement occurs, mortar shall cover all reinforcement bars and wire at least ¼″.

6.5 REINFORCEMENT shall be placed as shown on the working drawings, and shall be free from grease, oil, dirt, loose scale or rust, dry mortar or any other coating which might destroy or reduce its bond with the mortar. All reinforcement shall be covered in the joints with at least ¼″ of mortar, and shall be adequately stayed as required to prevent vibration or movement in partially set mortar. All bars shall be lapped at least 40 diameters at splices, around corners, and at intersections. Wires shall be spliced 18″ minimum. All splices shall be staggered. Vertical bars shall extend or be spliced from the footing to the bond beam and shall be hooked or bent into each.

San Carlos, California, City Park —W. P. A. Project built of stabilized soil brick in 1939-1940.

Ampitheater inclosed in walls of stabilized soil brick.

Recreation Building.

6.6 LINTELS of treated reinforced concrete shall be placed over openings when walls have been laid to the proper elevations.

6.7 BOND BEAMS of treated reinforced concrete shall be run continuously around the top of all masonry walls. The concrete shall be keyed into the vertical joints of the top course of brick. Bolts to anchor the plate shall be cast in the bond beam as shown on the drawings.

6.8 CURING: All masonry and concrete shall be kept continuously moist for three days after placing and shall be wetted periodically up to seven days after placing in order to avoid excessive drying.

7.0 FINISH OF WALLS

7.1 GENERAL: Walls may be unfinished, or smoothed and painted, or plastered with cement stucco or hard wall plaster (interior only). Plaster may be applied directly to the walls or metal lath may be nailed to the bricks.

7.2 PAINTING: The walls shall be rubbed with a wire brush or wet burlap, then washed down to remove dust. A prime wash coat made by mixing one sack of Medusa (or equal) white cement and about 6 gallons of water to a creamy consistency, shall be applied while the surface is damp, and wetted several times daily for five or six days until fully set and hardened. The cement wash may be tinted with pigment, or the cement primed surface may be painted with oil paints. (Cement wash coat is best applied when damp weather insures proper setting and curing.)

7.3 PLASTERING: If lath is desired, metal lath or 1″—18 gauge galvanized chicken wire may be fastened to the walls with concrete furring nails driven into the bricks. Cement stucco or hardwall plaster (interior only) may be applied in scratch, brown, and finish coats, according to standard practice.

8.0 WOOD STUD PARTITIONS shall be securely anchored to brick walls with perforated metal strap anchors, hooked and imbedded in the mortar joints between courses of brick.

9.0 SILLS AND PLATES of wood shall be bedded in mortar and anchored with bolts set in the foundation or bond beam.

10.0 RAFTERS AND CEILING JOINTS shall be bolted or securely spiked to plates as indicated on the drawings. Diagonal sheathing shall be applied to the rafters, or plywood sheathing to the ceiling joints, depending upon the roof pitch and the architectural features. (See Data Sheets No. 103, No. 104 and No. 110.)

11.0 VENEERED WALLS shall be constructed to Data Sheet No. 105 and No. 106. The stud walls shall be completely braced or sheathed to carry all design forces. Ties shall be selected to best suit the particular requirements. Veneer masonry shall be constructed in the same manner as other masonry walls, paragraph 6.0.

12.0 BRICK SUB FLOORS: The earth shall be leveled to suitable elevation below floor grade, then watered, compacted and dried. Sand and gravel shall be spread to minimum depth of 4″ and be compacted. Bricks shall be laid with treated cement mortar joints upon which the flooring shall be constructed and finished as specified. (See Data Sheet No. 104.)

13.0 UTILITY PIPES AND CONDUITS: Small size rigid conduits may be embedded in the walls in a manner similar to reinforcement providing that the strength of the walls is not impaired and that approval is obtained. Chases or grooves are in general not permitted. Large conduits and pipes may be carried below the floor or above the ceiling so as to avoid cutting the masonry or embedding in the masonry. Sleeves for pipes passing through the walls shall not be spaced closer than three diameters, center to center.

14.0 CHIMNEYS: Fire box, chimney throat, and flues shall be built in standard manner, and faced on the outside with stabilized soil bricks so placed as to not be exposed to the heat at any point. Bond beam of treated concrete shall be run around the chimney at the wall height. Construction above the bond beam shall provide a vertical space surrounding the flue lining and enclosed by the exterior brick facing. This space shall be filled with concrete, reinforced vertically at the corners, with bars which are anchored in the bond beam.

"The Fort" at Taft, in Kern County, California. Photograph at right shows section of massive walls two feet thick and eighteen feet high.

"The Fort" was built during 1939 of stabilized soil brick to house County, State and Federal offices.

"The Fort" is a replica of "Fort Sutter," the early California home and trading post built by Captain Sutter at the junction of the American and Sacramento rivers, now the city of Sacramento.

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Explanatory Note: To those persons who have known of Foster and Kleiser Company as one of the nation's leaders in outdoor advertising for more than 40 years, this question may have occurred, "How is it that Foster and Kleiser Company is producing and selling building material?"

Not usually known is the fact that Foster and Kleiser Company has long maintained its own manufacturing plants for the fabrication of its advertising structures and the production of much of the great volume of paint which it uses. With the advent of war, these manufacturing facilities and also the extensive painting experience and equipment of the Company were turned to war production and war activities (camouflage materials; protective concealment of camps, bases, harbor installations, factories, etc.)

Among the problems presented to the Company for solution was the need for a special type of building material and construction for blast walls, revetments, gun emplacements, etc. The solution to this problem was found in Caladobe. Careful, continued investigation, added to the practical experience with this material, showed clearly its exceptional advantages for standard building uses. Foster and Kleiser Company is proud therefore to offer this tested material as a contribution toward successful building in the postwar period, particularly as it affords an opportunity also for increasing employment at a time when jobs will be particularly needed.

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